

THE FAUNA OF BRITISH INDIA

INCLUDING

CEYLON AND BURMA.

PUBLISHED UNDER THE AUTHORITY OF THE SECRETARY OF
STATE FOR INDIA IN COUNCIL

EDITED BY LIEUT-COL J STEPHENSON, C I M B,
D Sc, F R S, I M S (ret)

CESTODA.

VOL. II.

BY

T SOUTHWELL, D Sc, PH D, A R C S, F R S E,
*Lecturer in Helminthology, School of Tropical Medicine, Liverpool,
National Scholar (1902), late Director of Fisheries to the
Governments of Bengal, and Bihar and Orissa, Scientific Adviser
and Inspector of Pearl Banks to the Ceylon Company of Pearl
Fishers and Honorary Assistant, Zoological Survey of India*



TODAY & TOMORROW'S PRINTERS AND PUBLISHERS
24-B/5, DESH BANDHU GUPTA ROAD,
NEW DELHI-110005

Originally Published
1930 LONDON, TAYLOR AND FRANCIS

Price Rs. 250
US \$. 50

Published by
TODAY & TOMORROW'S PRINTERS & PUBLISHERS
24B/5, Karol Bagh, New Delhi-110005(INDIA)

Printed by
GOYAL OFFSET PRINTERS
308 /6E Shahzada Bagh
DayaBasti, W DELHI-35

EXPLANATION OF LETTERING

<i>c</i> , cirrus	<i>p</i> , parenchyma
<i>cm</i> , circular muscle fibres	<i>pg</i> , prostatic glands
<i>cp</i> , cirrus pouch	<i>puo</i> , paruterine organ
<i>cu</i> , cuticle	<i>rm</i> , retractor muscle
<i>dev</i> , dorsal excretory vessel	<i>rs</i> , receptaculum seminis
<i>dvm</i> , dorso ventral muscle fibres	<i>s</i> , spines
<i>e</i> , eggs	<i>scm</i> , subcuticular muscles
<i>eb</i> , excretory bladder	<i>sg</i> , shell gland
<i>ec</i> , egg capsules	<i>sph</i> , sphincter
<i>ev</i> , excretory vessels	<i>t</i> , testes
<i>evs</i> , external vesicula seminalis	<i>tm</i> , transverse muscle fibres
<i>fc</i> , fertilization canal	<i>u</i> , uterus
<i>fp</i> , fibrous pad	<i>ud</i> , uterine duct
<i>ia</i> , genital atrium	<i>up</i> , uterine pore
<i>gp</i> , genital pore	<i>ur</i> , uterine reticulum
<i>gs</i> , genital sucker	<i>us</i> , uterine sac
<i>ipg</i> , interproglottidal gland	<i>v</i> , vagina
<i>ivs</i> , internal vesicula seminalis	<i>vd</i> , vas deferens
<i>l</i> , lappets	<i>ve</i> , vasa efferentia
<i>lm</i> , longitudinal muscles	<i>vev</i> , ventral excretory vessel
<i>mp</i> , medullary parenchyma	<i>vg</i> , vitelline gland
<i>n</i> , nerve	<i>vs</i> , vesicula seminalis
<i>o</i> , ovary	<i>vd</i> , vitelline duct
<i>om</i> , oblique muscle fibres	<i>vu</i> , vulva
<i>ovd</i> , oviduct	<i>va</i> , vaginal uterine aperture

SYSTEMATIC INDEX.

	Page		Page
Superfam VI TÆNIOIDIA		(5) manubriata <i>Raillet</i> ,	
<i>Zwicker</i>	1	<i>Henry</i> , & <i>Bouche</i>	36
		sp <i>Gargui</i>	36
Fam 1 Tænuidæ <i>Ludwig</i>	2	Gen 2 <i>Moniezia Blanchard</i>	37
Genus <i>Tænia Linnæus</i>	7	(1) expansa (<i>Rudolphi</i>)	39
(1) solium <i>Linnæus</i>	7	(2) benedeni (<i>Moniez</i>)	
(2) saginata <i>Goeze</i>	9	<i>Blanchard</i>	40
(3) hydatigena <i>Pallas</i>	11	(3) alba (<i>Perroncito</i>)	
(4) echinococcus (<i>Zeder</i>)		<i>Blanchard</i>	41
<i>Siebold</i>	12	Gen 3 <i>Cittotænia Riehm</i>	41
(5) pisiformis (<i>Bloch</i>)		(1) pectinata (<i>Goeze</i>)	42
<i>Gmelin</i>	14	<i>avicola Fuhrmann</i>	43
(6) multiceps <i>Leske</i>	16	Gen 4 <i>Bertiella Stiles</i> &	
(7) tremuliformis (<i>Batsch</i>)		<i>Hassall</i>	43
<i>Wolffhugel</i>	18	<i>studenii (Blanchard)</i>	
(8) ovalis (<i>Gervais</i>)	20	<i>Stiles</i> & <i>Hassall</i>	44
(9) ovis (<i>Cobbold</i>) <i>Ransom</i>	21	Gen 5 <i>Aporina Fuhrmann</i>	45
(10) reticula <i>Linstow</i>	22	<i>delafondii (Raillet)</i> ,	
(11) gageii (<i>Hall</i>)	22	<i>Baer</i>	45
<i>Doubtful Species</i>		Gen 6 <i>Parona Diamare</i>	46
(1) meander <i>Linstow</i>	23	<i>columbæ Fuhrmann</i>	47
(2) sp <i>Linstow</i>	24	Subfam II THYSANOSOMINÆ	
(3) sp <i>Southwell</i>	24	<i>Fuhrmann</i>	49
(4) sp <i>Southwell</i>	24	Gen 1 <i>Thysanosoma Diesing</i>	50
(5) sp (cystic form)		Gen 2 <i>Stilesia Raillet</i>	50
<i>Meggitt</i>	24	(1) globipunctata (<i>Rivolta</i>)	
		<i>Raillet</i>	50
Fam 2 Anoplocephalidæ		(2) vittata <i>Raillet</i>	51
<i>Cholodkovsky</i>	25	Gen 3 <i>Avitellina Gough</i>	53
Subfam I. ANOPLOCEPHALINÆ		(1) centripunctata	
<i>Fuhrmann</i>	25	(<i>Rivolta</i>) <i>Raillet</i>	53
Gen 1 <i>Anoplocephala Blanchard</i>	26	(2) linoia <i>Woodland</i>	55
(1) perfoliata (<i>Goeze</i>)	27	(3) gough <i>Woodland</i>	57
(2) magna (<i>Abildgaard</i>)	30	Subfam III LINSTOWIINÆ <i>Fuhrmann</i>	58
(3) mamillana (<i>Mchlis</i>)	30	Gen 1 <i>Linstowia Zschokke</i>	59
(4) gigantea (<i>Peters</i>) <i>Blanchard</i>	32	sp <i>Southwell</i>	59
		Gen 2 <i>Oochoristica Luke</i>	59
		(1) cryptobothrium (<i>Linstow</i>) <i>La Rue</i>	60

	Page		Page
(2) <i>agamæ Baylis</i>	61	(16) <i>Railletina</i> (<i>Railletina</i>)	
(3) <i>classiceps Baylis</i>	62	<i>famosa Meggitt</i>	88
(4) <i>amphisbeteta Meggitt</i>	64	(17) <i>Railletina</i> (<i>Railletina</i>)	
(5) <i>sigmoides Moghe</i>	65	<i>flabialis Meggitt</i>	89
(6) <i>figurata Meggitt</i>	66	(18) <i>Railletina</i> (<i>Railletina</i>)	
(7) <i>hibrata Meggitt</i>	67	<i>celebensis var pauci-</i>	
Gen 3 <i>Thysanotenia Bed-</i>		<i>capsulata Meggitt</i>	90
<i>daid</i>	68	Subgen (b) <i>Paromiella Fuh-</i>	
<i>incognita Meggitt</i>	68	<i>mann</i>	90
Fam 3 Davaineidæ Fuh-		(1) <i>Railletina</i> (<i>Paromiella</i>)	
<i>mann</i>	69	<i>uogalli (Modeer)</i>	91
Subfam <i>DAVAINEINÆ</i> Braun	69	<i>Fuhmann</i>	
Gen 1 <i>Davainea Blanchard</i>	72	(2) <i>Railletina</i> (<i>Paromiella</i>)	
<i>proglottina (Davaine)</i>		<i>cinclata (Rudolphi)</i>	93
<i>R. Blanchard</i>	72	(3) <i>Railletina</i> (<i>Paromiella</i>)	
Gen 2 <i>Railletina Fuh-</i>		<i>coquina (Fuhmann)</i>	93
<i>mann</i>	74	(4) <i>Railletina</i> (<i>Paromiella</i>)	
Subgen (a) <i>Railletina Stiles</i>		<i>ceylonica (Baczynska)</i>	94
& <i>Orleman = Ran-</i>		(5) <i>Railletina</i> (<i>Paromiella</i>)	
<i>sonna Fuhmann</i>	74	<i>tragopani (Southwell)</i>	95
(1) <i>Railletina</i> (<i>Railletina</i>)		(6) <i>Railletina</i> (<i>Paromiella</i>)	
<i>tetragona (Mohn)</i>	74	<i>facile Meggitt</i>	96
(2) <i>Railletina</i> (<i>Railletina</i>)		(7) <i>Railletina</i> (<i>Paromiella</i>)	
<i>leptosoma (Dusing)</i>	75	<i>contorta Zschokke</i>	97
(3) <i>Railletina</i> (<i>Railletina</i>)		Subgen (c) <i>Skijabima Fuh-</i>	
<i>friedbergeri (Linstow)</i>	76	<i>mann</i>	97
(4) <i>Railletina</i> (<i>Railletina</i>)		(1) <i>Railletina</i> (<i>Skijabima</i>)	
<i>celebensis (Tschika)</i>	77	<i>cecticillus (Mohn)</i>	97
(5) <i>Railletina</i> (<i>Railletina</i>)		(2) <i>Railletina</i> (<i>Skijabima</i>)	
<i>microscolecina (Fuh-</i>		<i>centropi (Southwell)</i>	98
<i>mann)</i>	77	Subgen (d) <i>Fuhmannetta</i>	
(6) <i>Railletina</i> (<i>Railletina</i>)		<i>Stiles & Orleman (=</i>	
<i>aiuensis (Fuhmann)</i>	78	<i>lohnstoma Fuh-</i>	
(7) <i>Railletina</i> (<i>Railletina</i>)		<i>mann)</i>	99
<i>cohm Baczynska</i>	78	(1) <i>Railletina</i> (<i>Fuhman-</i>	
(8) <i>Railletina</i> (<i>Railletina</i>)		<i>netta echinobothrida</i>	
<i>spiralis (Baczynska)</i>	79	<i>(Meyn)</i>	100
(9) <i>Railletina</i> (<i>Railletina</i>)		(2) <i>Railletina</i> (<i>Fuhmann-</i>	
<i>polchalis Kotlan</i>	80	<i>etta pseudoerlino-</i>	
(10) <i>Railletina</i> (<i>Railletina</i>)		<i>bothrida (Meggitt)</i>	101
<i>fuhmanni (South-</i>		(3) <i>Railletina</i> (<i>Fuhmann-</i>	
<i>well)</i>	81	<i>etta bunnica Mey-</i>	
(11) <i>Railletina</i> (<i>Railletina</i>)		<i>gitt</i>	101
<i>parvuncinata Meggitt</i>	84	(4) <i>Railletina</i> (<i>Fuhmann-</i>	
(12) <i>Railletina</i> (<i>Railletina</i>)		<i>etta korkei Joyeux &</i>	
<i>torquata (Meggitt)</i>	84	<i>Houdemei</i>	102
(13) <i>Railletina</i> (<i>Railletina</i>)		<i>Species of Railletina—</i>	
<i>ragpurensis Moghe</i>	86	<i>Subgenus unknown</i>	
(14) <i>Railletina</i> (<i>Railletina</i>)		(1) <i>Railletina</i> (<i>anatina</i>)	
<i>quadrirtesticulata</i>		<i>(Fuhmann)</i>	103
<i>Moghe</i>	87	(2) <i>Railletina</i> (<i>reynoldsæ</i>)	
(15) <i>Railletina</i> (<i>Railletina</i>)		<i>Meggitt</i>	103
<i>flaccida Meggitt</i>	88		

	Page		Page
(3) <i>Railletina fatalis</i> Meggitt	104	(15) <i>furcata</i> (Stieda)	134
(4) <i>Railletina fluxa</i> Meggitt	105	(16) <i>medici</i> (Stoss) Fuhrmann	135
(5) <i>Railletina funebris</i> Meggitt	105	(17) <i>megalorchis</i> (Luhe)	136
(6) <i>Railletina indica</i> Meggitt	105	(18) <i>simplex</i> Fuhrmann	137
spp Southwell	105, 106	(19) <i>zosteropsis</i> Fuhrmann	137
sp Meggitt	106	(20) <i>annandalei</i> Southwell	139
sp (? <i>paradisea</i> Fuhrmann)	106	(21) <i>rustica</i> (Meggitt)	141
Gen 4 <i>Cotugma</i> <i>Diamare</i>	107	(22) <i>ficticia</i> (Meggitt)	141
(1) <i>digonophora</i> (Pasquale)	107	(23) <i>minutissima</i> (Meggitt)	142
(2) <i>fuhrmanni</i> (Baczynska)	108	(24) <i>solitaria</i> (Meggitt)	142
(3) <i>biotogeis</i> Meggitt	109	(25) <i>phalacrocorax</i> Woodland	143
(4) <i>margareta</i> Beddard	110	(26) <i>cleici</i> (Clerc) Fuhrmann	144
(5) <i>fastigata</i> Meggitt	111	<i>Species inquirendae</i>	
(6) <i>cuneata</i> var <i>tenuis</i> Meggitt	112	(1) sp (? <i>collaris</i> (Batsch) Fuhrmann = <i>sinuosa</i> Cohn)	146
(7) <i>cuneata</i> var <i>neivosa</i> Meggitt	113	(2) <i>fasciata</i> (Rudolph) ? Klabbe	146
(8) <i>semi</i> Meggitt	113	(3) sp (? <i>microcephala</i> (Rudolph) Fuhrmann)	146
Subfam II <i>OPHRIOCOTYLINAE</i> Fuhrmann	114	(4) <i>capillarioides</i> Fuhrmann	147
Genus <i>Ophryocotyle</i> <i>Fries</i>	114	(5) ? sp <i>Gauger</i>	147
<i>zeylanica</i> Linstow	114	spp Southwell	147, 148
Fam 4 <i>Hymenolepididae</i>		sp (? <i>asymmetrica</i> Fuhrmann)	147
<i>Raillet</i> & <i>Henry</i>	116	sp <i>Moghe</i>	148
Gen 1 <i>Hymenolepis</i> <i>Weinland</i>	118	sp <i>Joyeux</i> & <i>Houdemei</i>	148
(1) <i>dimmuta</i> (Rudolph)	119	Subgen <i>Ichimocotyle</i> <i>Blanchard</i>	149
(2) <i>lanceolata</i> (Bloch) <i>Weinland</i>	121	(1) <i>rossetei</i> R <i>Blanchard</i>	149
(3) <i>murina</i> (Dugardini) R <i>Blanchard</i>	122	(2) <i>malensis</i> Clerc	150
(4) <i>fusa</i> (Klabbe) <i>Fuhrmann</i>	124	Gen 2 <i>Fimbriaria</i> <i>Frohlich</i>	151
(5) <i>spinosa</i> <i>Linstow</i>	124	<i>fasciolaris</i> (Pallas) <i>Wolffhugel</i>	151
(6) <i>septaria</i> <i>Linstow</i>	125	Fam 5 <i>Dilepididae</i> <i>Raillet</i> & <i>Henry</i>	153
(7) <i>clausa</i> <i>Linstow</i>	126	Subfam I <i>DIFILINAE</i> <i>Fuhrmann</i>	154
(8) <i>rugosa</i> <i>Clerc</i> var <i>bi-manica</i> Meggitt	126	Gen 1 <i>Dilepis</i> <i>Weinland</i>	155
(9) <i>kempfi</i> (Southwell) <i>Mayhew</i>	127	(1) <i>campylincistota</i> (Wedl) <i>Fuhrmann</i>	155
(10) <i>fasciminosa</i> (Goeze)	129	(2) sp <i>Southwell</i>	157
(11) <i>gracilis</i> (Zeder) <i>Cohn</i>	130	Gen 2 <i>Lateriporus</i> <i>Fuhrmann</i>	157
(12) <i>sphenocephala</i> (Rudolph) <i>Fuhrmann</i>	131	<i>spinosa</i> <i>Fuhrmann</i>	157
(13) <i>coronula</i> (Dugardini) <i>Cohn</i>	132		
(14) <i>liguloides</i> (Gervais)	132		

	Page		Page
Gen 3 <i>Chœanotœnia</i> <i>Raillet</i>	159	Gen 2 <i>Rhabdometra</i>	
(1) <i>infundibuliformis</i>		<i>Cholodkovsky</i>	186
(<i>Goeze</i>) <i>Raillet</i>	159	(1) <i>tomica</i> <i>Cholodkovsky</i>	187
(2) <i>decacantha</i> <i>Fuhrmann</i>	160	(2) <i>dendrocitta</i> <i>Woodland</i>	188
(3) <i>barbara</i> <i>Meggitt</i>	161		
(4) <i>galbulæ</i> (<i>Zeder</i>)		Fam 6 Mesocestoididæ	
<i>Cohn</i>	162	<i>Fuhrmann</i>	189
(5) <i>magnicirrosa</i> <i>Meggitt</i>	162	Gen <i>Mesocestoides</i> <i>Vaillant</i>	189
(6) sp <i>Southwell</i>	163	(1) <i>lineatus</i> (<i>Goeze</i>) <i>Raillet</i>	190
Gen 4 <i>Anomotœnia</i> <i>Cohn</i>	163	(2) <i>mesorchis</i> <i>Cameron</i>	192
(1) <i>volvulus</i> (<i>Linstow</i>)			
<i>Fuhrmann</i>	163	Fam 7 Nematotœnidæ <i>Luthe</i>	193
(2) <i>acollis</i> <i>Fuhrmann</i>	164	Genus <i>Nematotœnia</i> <i>Luthe</i>	194
(3) <i>constricta</i> (<i>Mohr</i>)		<i>dispar</i> (<i>Goeze</i>) <i>Luthe</i>	194
<i>Cohn</i>	165		
Gen 5 <i>Amœbotœnia</i> <i>Cohn</i>	165	Fam 8 Amabiliidæ <i>Fuhr-</i>	
<i>sphenoides</i> <i>Raillet</i>	165	<i>mann</i>	194
Gen 6 <i>Parvinostrum</i> <i>Fuhr-</i>		Genus <i>Amabilia</i> <i>Diamare</i>	194
<i>mann</i>	167	<i>lamelligera</i> (<i>Owen</i>)	
<i>magnusomum</i> , n sp	168	<i>Diamare</i>	194
Gen 7 <i>Glyporhynchus</i>			
<i>Nothmann</i>	170	Fam 9 Diploposthidæ <i>Poche</i>	197
<i>pusillus</i> <i>Nothmann</i>	170	Genus <i>Diploposthe</i> <i>Jacobi</i>	197
Gen 8 <i>Pentorchis</i> <i>Meggitt</i>	171	<i>lævis</i> (<i>Bloch</i>) <i>Jacobi</i>	198
<i>arctus</i> <i>Meggitt</i>	171		
Gen 9 <i>Deltoceras</i> <i>Meggitt</i>	172	Fam 10 Acoleidæ <i>Ransom</i>	198
<i>ornithium</i> <i>Meggitt</i>	172	Genus <i>Glyocœlia</i> <i>Fuhrmann</i>	199
Gen 10 <i>Cyclorchida</i> <i>Fuhr-</i>		<i>paradoxa</i> (<i>Linstow</i>)	
<i>mann</i>	173	<i>Fuhrmann</i>	199
<i>omalancristrota</i> (<i>Wedl</i>)			
<i>Fuhrmann</i>	173	Fam 11 Tetrabothriidæ	
Subfam 11 DIPYLIDINÆ <i>Stiles</i>	175	<i>Linton</i>	201
Gen 1 <i>Dipylidium</i> <i>Leuckart</i>	175	Genus <i>Tetrabothrius</i> <i>Rudolphi</i>	201
(1) <i>caninum</i> (<i>Linnæus</i>)	176	<i>eiosius</i> (<i>Loenberg</i>)	
(2) <i>gerardi</i> <i>Setti</i>	176	<i>Fuhrmann</i>	231
(3) <i>sexcoronatum</i> <i>Ratz</i>	178		
sp <i>Gaiger</i>	178	Fam 12 Diœcocestidæ nov	202
Gen 2 <i>Monopyldium</i> <i>Fuhr-</i>		Genus <i>Diœcocestus</i> <i>Fuhrmann</i>	202
<i>mann</i>	178	novæ-guinæe	202
<i>chandleri</i> <i>Moghe</i>	179		
Gen 3 <i>Southwellia</i> <i>Moghe</i>	180	Genera of uncertain Systematic	
<i>gullinarum</i> (<i>Southwell</i>)	180	Position	
Gen 4 <i>Plechoanotœnia</i>		Gen 1 <i>Echinobothrium</i> <i>van</i>	
<i>Meggitt</i>	181	<i>Beneden</i>	203
<i>microsoma</i> (<i>Southwell</i>)	181	(1) <i>typus</i> <i>van Beneden</i>	204
Gen 5 <i>Milika</i> <i>Woodland</i>	183	(2) <i>affine</i> <i>Dusing</i>	207
<i>œdicnemus</i> <i>Woodland</i>	183	(3) <i>rhinoptera</i> <i>Shipley</i> &	
		<i>Hornell</i>	208
Subfam 111 PARVETFININÆ		(4) <i>longicollis</i> <i>Southwell</i>	209
<i>Ransom</i>	184		
Gen 1 <i>Metrohasthes</i> <i>Ransom</i>	185		
<i>lucida</i> <i>Ransom</i>	185		

	Page		Page
Gen 2 <i>Pilleisii</i> Southwell	211	(3) <i>Cestoda</i> sp <i>Mcggett</i>	215
<i>oweni</i> Southwell	211	(4) <i>Cestoda</i> spp <i>Moqhe</i>	215
Gen 3 <i>Discocephalum</i>		(5) <i>Cysticercus</i> Shipley	215
<i>Linton</i>	212		
<i>pileatum</i> Linton	212	<i>Addenda</i>	
Gen 4 <i>Diagonobothrium</i>		Genus <i>Spiniloculus</i> Southwell	249
<i>Shipley & Hornell</i>	214	<i>mavensis</i> Southwell	249
<i>asymmetrum</i> Shipley		Genus <i>Phyllobothrium</i> van	
& <i>Hornell</i>	215	<i>Beneden</i>	251
		<i>gracile</i> Wedl	251
<i>Worms of uncertain Identity</i>		Genus <i>Railletina</i> Fuhrmann	254
(1) <i>Cestoda</i> sp <i>Southwell</i>	215	(<i>Railletina</i>) <i>maple-</i>	
(2) <i>Cestoda</i> sp <i>Southwell</i>	215	<i>stonei</i> , n sp	254

Superfamily VI TÆNIOIDEA Zwicke, 1841

Synonym —Order Cyclophyllidea Braun, 1900

Strobila sometimes composed of a few (three or four), but usually of numerous proglottides (segments) The head bears four muscular cup-shaped suckers (acetabula), which may be armed with spinules A rostellum, which may or may not carry hooks, is present in some species, or the head may be lost and a pseudoscolex developed (*Fimbriaria*) External segmentation distinct, except in a few species (*Antellina*, *Nemato-tænia*), and corresponding with the internal segmentation The genital pores are lateral except in the Mesocestoididæ Each segment may contain one or more sets of genital organs The testes vary in number from one to several hundreds Ovary single, usually bilobed, vitelline gland single, compact, situated behind the ovary except in the Tetrabothrudæ A vagina is absent in the Acoleidæ and in the Amabiludæ it is replaced by an accessory canal The uterus may consist of a simple sac or it may be replaced by egg-capsules, or by one or more paruterine organs, uterine pores are absent except in some species of the Tetrabothrudæ, the eggs being liberated as a result of degeneration of the muscular tissue and parenchyma Gravid segments are passed in the fæces Larval stage, where known, usually a hollow sphere with one or more invaginations, each of which bears a scolex, or with a bladder containing daughter-bladders, both of which contain numerous scoleces In some larval forms the bladder is almost absent Adults in mammals, birds, reptiles, and amphibians

Key to Families

- | | | |
|---|--|-------------------------------|
| 1 | Sexes separate, <i>z e</i> , strobila either male or female | [p 202. |
| | Sexes united, <i>z e</i> , strobila contains both male and female organs | Diœcocestidæ , nov , |
| 2 | Genital pores on ventral (flat) surface of segment | 2 |
| | Genital pores marginal | Mesocestoididæ , p 189 |
| 3 | Vitelline gland anterior to ovary, suckers usually with anterior lappets | 3 |
| | Vitelline gland posterior to ovary, suckers without anterior lappets | Tetrabothrudæ , p 201 |
| 4 | Uterus composed of median stem with lateral branches, eggs with a thick, radially striated embryophore | 4 |
| | Uterus sac-like, reticulate, or unstable, eggs with thin embryophores | Tænudæ , p 2. |
| | | 5 |

- | | | |
|----|--|---------------------------|
| 5 | Head armed with numerous minute hammer-shaped hooks | Davaineidæ, p 69 |
| | Head not armed with hammer-shaped hooks | 6 |
| 6 | Strobila cylindrical, external segmentation incomplete | Nematotænidæ, p 193 |
| | Strobila flat, outer segmentation complete with few exceptions | 7 |
| 7 | Segments with never more than four testes, genital pores single, unilateral | p 116 |
| | Segments with numerous testes, never less than four | Hymenolepididæ, |
| 8 | Vagina absent, replaced by an accessory duct, rostellum armed | 8 |
| | Vagina present (except in <i>Aporina</i>) | Amabilidæ, p 194 |
| 9 | Vaginal pore absent | 9 |
| | Vaginal pore present | Acoleidæ, p 198 |
| 10 | Head unarmed | 10 |
| | Head armed (except in <i>Metorhasthes</i> and <i>Rhabdometra</i>) | [p 25
Anoplocephalidæ, |
| 11 | Cirrus very large armed with prominent large spines, worms large and muscular | 11 |
| | Cirrus small, when armed, the spines are inconspicuous worms usually small and fragile | Diploposthidæ, p 197 |
| | | Dilepididæ, p 153 |

Family I TÆNIIDÆ Ludwig, 1886

Rostellum rarely rudimentary, usually well developed and armed with a double circle of hooks, the hooks in the anterior circle being larger than, and alternating with, those in the posterior circle, rarely with a single circle, or unarmed. Suckers unarmed. Gravid proglottides longer than broad. A single set of reproductive organs in each segment. Genital pores irregularly alternate. Testes numerous. Ovary bilobed, posterior to testes (except in *Cladotænia* and *Catenotænia*). Uterus with a median stem and lateral branches, eggs with a thick, radially striated embryophore (except in *Cladotænia* and *Catenotænia*). Adults in birds and mammals.

Type-genus — *Tænia* Linnæus, 1758

Although the genus *Tænia* does not contain a large number of species, it has been subdivided into at least five genera, species with an unarmed head, like *T. saginata*, have been placed in a genus called *Tæniarhynchus* Weinland, 1858, whilst *T. taeniæformis* has been referred to two distinct genera, viz *Hydatigera* Lam, 1816, and *Reditænia* Sambon, 1924, on account of the fact that its larval form (*Cysticercus fasciolaris* Rudolphi, 1808) is strobilate.

Hall (1919) divides the genus *Tænia* into three genera, viz —

(1) *Tænia* Linnæus, 1758. The rostellum is armed with a double crown of hooks except in (a) *T. saginata*, where the head is unarmed, and (b) *T. monostephanos*, where the head bears a single crown of hooks. Strobila usually large. Larva a

cysticercus (one bladder containing one head) Found in mammals Type-species —*Tænia solium* Linnæus, 1758

(2) *Multiceps* Goeze, 1782 Large worms, rostellum armed with a double crown of hooks Larval stage a cœnurus (one bladder with many heads) Type-species —*Multiceps multiceps* (Leske, 1780)

(3) *Echinococcus* Rudolphi, 1801 Strobila small and composed of not more than four or five segments, of which only the posterior (terminal) one is gravid head with a double crown of hooks, larval stage an echinococcus. This is a bladder-worm with a thick laminated wall, usually with daughter cysts arising internally or externally Brood capsules develop in both the parent and the daughter cysts, and contain large numbers of minute scoleces invisible to the naked eye Adult worms in carnivorous mammals Larval stage in herbivorous and omnivorous mammals and birds Type-species —*Echinococcus granulosus* (Batsch, 1786)

The writer is of opinion that Hall's classification, based as it is on larval characters, is untenable When a diagnosis is attempted of, for example, a worm passed by a dog, no information is available as to whether the larval form is a cysticercus or a cœnurus The identification of the worm should be possible on the morphological characters of the adult Several species can be easily so identified *T. echinococcus* is distinguished by its minute size, *T. saginata* by its unarmed head, *T. monostephanos* by a single crown of hooks, *T. tæniæformis* by the large size of the hooks, etc But the greatest difficulty exists in making a diagnosis of most species of *Tænia*, especially those found in dogs This is due to the fact that characters ascribed to the various species are very variable

Until recently, only two species of the genus *Tænia* were known which during their development gave rise to a cœnurus, viz, *T. multiceps* Leske, 1780, the larval form of which occurs in the brain of sheep, and *T. serialis* (Gervais, 1847) the larval form of which occurs in the subcutaneous tissues etc of the rabbit Certain Italian and German helminthologists were of opinion that these two worms were identical, and that the eggs, when swallowed by rabbits, could only develop in connective tissues, and when swallowed by sheep in the nervous tissues Baillet (1863), however, proved experimentally that when dogs were fed with the cœnurus from the subcutaneous tissues of a rabbit, and the adult worm obtained, the egg from the adult worm would not infect sheep, and, similarly, that the eggs from the adult worms derived from a brain cœnurus would not infect rabbits

Gaiger (1907) recorded a cœnurus from the connective tissues of the goat in India As the cyst occurred in the connective tissues, and not in the brain, and further, as rabbits do not occur in India, Gaiger concluded that the larva he had found

Principal Characters of

	Number of hooks	Size of large hooks, μ	Size of small hooks, μ	Length of worm, mm
<i>T. multiceps</i> (Leske, 1790)	22-32	150-170	90-130	400-1000
<i>T. hydatigena</i> Pallas, 1766	22-44	170-220	110-160	750-5000
<i>T. ovis</i> (Cobbold, 1869)	24-36	156-188	96-128	450-1000
<i>T. solium</i> Linnæus, 1767	25-50	160-180	110-140	2000-8000
<i>T. serialis</i> (Gervais, 1847)	26-32	135-175	78-120	200-720
<i>T. krabbei</i> Momez, 1879	26-34	148-170	85-120	260
<i>T. teniaformis</i> (Batsch, 1786)	26-52	380-420	250-270	150-160
<hr/>				
<i>T. gageri</i> (Hall, 1916)	28-32	160-180	115-150	250-1800
<i>T. balanticeps</i> Hall, 1910	28-32	145	93-98	240
<i>T. antarctica</i> Fuhrmann, 1922	28-34	144-156	92-102	250
<i>T. brauni</i> Setti, 1897	30-32	130-140	85-90	100-180
<i>T. regis</i> Baer, 1923	32	290	190	160
<i>T. crassiceps</i> Rudolphi, 1810	32-34	186	135	120-220
<i>T. hyænæ</i> Baer, 1926	32-38	223	127	300
<i>T. retracta</i> Lanstow, 1904	34	308	211	550
<i>T. pisiformis</i> (Bloch, 1780)	34-48	225-294	132-177	600-2000
<hr/>				
=? <i>T. polycalcaria</i> Lanstow, 1903	38	238	158	108
<i>T. infantis</i> Bacigalupo, 1922	35-40	410	260	300
<i>T. laticollis</i> Rudolphi, 1819	38-60	380-420	150-183	50-95
<i>T. omassa</i> Lube, 1910	40	270-290	90	500-600
<i>T. macrocystis</i> Diesing, 1850	60-74	320-365	180-200	120
<hr/>				
<i>T. parva</i> Baer, 1926	44	361	228	55
<i>T. polyacantha</i> Leuckart, 1856	62	58	34	120
<i>T. erythræa</i> Setti, 1897	20	85	95	140-170
<i>T. philippina</i> Garrison, 1907	—	—	—	800-1000
<i>T. saginata</i> (Goeze, 1782)	—	—	—	4000-10,000
<i>T. confusa</i> Ward, 1895	—	—	—	5000-8000
<i>T. bremneri</i> Stephens, 1908	—	—	—	?

various Species of *Tænia*

Uterine branches	Eggs, μ	Host	Distribution
9-26	29-37	<i>Canis fam</i> , <i>C nebrascensis</i> , <i>Vulpes lagopus</i>	Cosmopolitan
5-10	38-39 34-35	<i>Canis fam</i> , <i>Thous lupus</i> , <i>T mesomelas</i>	Cosmopolitan
20 25	30-34 24-28	<i>Canis fam</i>	Europe, Africa, Australia, U S
7-10	31-36	<i>Homo sapiens</i>	Cosmopolitan (sporadic)
20-25	31-34 29-30	<i>Canis fam</i>	Europe, Asia, Australia, U S
10	?	<i>Canis fam</i>	Iceland, Alaska
17-18	31-37	<i>Felis catus</i> , <i>F maniculata</i> , <i>F melivora</i> , <i>Catopuma</i> <i>eyria</i> , <i>Uncia concolor</i> , <i>On-</i> <i>coides mitis</i> , <i>O uendi</i> , <i>O tigrina</i> , <i>Cervaria</i> <i>uenta</i> , <i>Arctogale ermi-</i> <i>neus</i> , <i>Mustela foina</i> , <i>M martes</i> , <i>Putorius</i> <i>putorius</i>	Europe, Asia, U S, S America
12-15	25-30	<i>Canis fam</i>	India, Ceylon
16-17	29-37 27-33	<i>Canis fam</i> , <i>Cervaria rufa</i>	U S
13-15	20	<i>Canis fam</i>	Antarctic
10-12	35-38	<i>Canis fam</i>	Erythrea, Italy
7-10	40	<i>Uncia leo</i>	Sudan
8	25 19	<i>Vulpes aloper</i>	Europe
12-14	34 27	<i>Hyæna brunea</i>	S Africa
Immature	—	<i>Vulpes ferilatus</i>	Tibet (?)
8-14	37 32	<i>Canis fam</i> , <i>C nebrascensis</i> , <i>Thous latians</i> , <i>Felis</i> <i>catus</i> , <i>Uncia tigris</i> , <i>Leo-</i> <i>pardus pardus</i> , <i>Urocyon</i> <i>cuereo argenteus</i>	Cosmopolitan
—	—	<i>Felis pardus</i>	Ceylon
?	35-40	<i>Homo sapiens</i>	S America
Immature	—	<i>Lynx lynx</i>	?
4-5	40	<i>Uncia concolor</i> , <i>Oncoides</i> <i>tigrina</i>	S America
8-15	34-48 25-27	<i>Cervaria rufa</i> , <i>C fasciata</i> , <i>Catopuma jaguarandi</i> <i>Oncoides tigrina</i> , <i>O</i> <i>uendi</i> , <i>Felis macrura</i> , <i>F sp</i> , <i>Galictis sp</i>	S America, U S
9-14	27 23	<i>Genetta ludia</i>	S Africa
8	28 22	<i>Vulpes aloper</i>	Europe
6-14	27 28	<i>Thous mesomelas</i>	Abyssinia
?	35-41 26-35	<i>Homo sapiens</i>	Philippines
15-30	30-40 20-30	<i>Homo sapiens</i>	Cosmopolitan
14-18	39 30	<i>Homo sapiens</i>	Texas
22-24	39 30	<i>Homo sapiens</i>	Nigeria

must be that of *T. serialis* Dey (1909) recorded the same larval parasite not only from connective and subcutaneous tissues etc., but also from the brain of the goat, in India Southwell (1912) independently recorded *Cœnurus serialis* from the goat in Ceylon. The occurrence of the same cœnurus in both the brain and connective tissues etc. of the goat is a very striking fact, because in the rabbit it is extremely rare for a cœnurus to be found in the brain, whilst in the sheep it is rarely found outside the nervous tissue.

Hall (1916) erected a new species of *Tænia*, which he called *Multiceps gageri*, for this worm. The adult is found in the dog. So far as the writer is aware, no morphological differences exist between the cœnuri of *T. multiceps* found in the brain of sheep, *T. serialis* from the connective tissues of the rabbit, and *T. gageri* found in both the brain and connective tissues of the Indian goat.

The three adult worms which are said to develop from the above cœnuri are so similar that the writer has found it practically impossible to distinguish one from the other even in cases in which the adult worm has been obtained as a result of feeding experiments, and in which it was definitely known that the cœnurus had been obtained from the brain of a sheep in the one case or the connective tissues of a rabbit in the other.

It will be clear that these three species are very closely related, and it is even possible that they are morphologically identical. Developmentally, *T. multiceps* and *T. serialis* appear to be quite distinct because in the first case the larvæ are nearly always found in the brain, whilst in the other they are usually found in connective tissues, but the occurrence of a cœnurus in both these positions in the Indian goat justifies the supposition of their possible identity. In this connection it may be noted that the *Ascaris* found in the pig is morphologically identical with the *Ascaris* found in man. Nevertheless, it appears to be impossible to infect man with the larvæ obtained from the pig *Ascaris* or to infect the pig with the larvæ obtained from man.

In view of the fact that worms and their larvæ generally show a predilection for particular sites in the different hosts which they inhabit, it could not be regarded as astonishing if it proved to be a fact that the egg of *T. multiceps* found conditions suitable for its development only in the brain of sheep, or, in the case of rabbits, in the connective tissue, whilst in the goat the conditions were equally suitable in both the above-named sites.

The writer here accepts the genus *Tænia* in its widest application. The species of this genus are so closely related that it is impossible to give a satisfactory differential key, as will be seen from the table on pp. 4 and 5 (after Baer), which gives the principal characters of all known species.

Genus TÆNIA Linnæus, 1758

With the characters of the family

Type-species — *Tæniasolium* Linnæus, 1758(1) *Tæniasolium* Linnæus, 1758 (Fig 222)

Synonyms numerous, amongst which are the following —

Tænias cucurbitina Pallas, 1781*T. pellucida* Goetz, 1782*T. vulgaris* Werner, 1782*T. dentata* Gmelin, 1790*Cysticercus pyriformis* (Trentler, 1793)*Halysis solium* Zeder, 1800*T. humana armata* Biera, 1802*C. canis* Rudolphi, 1819*T. armata* Pinnerye, 1823*T. acanthotænia* Weinland, 1858*T. (Cystotænia) solium* R. Leuckart, 1862*C. suis* Cobbold, 1869

Adult worms in man Ceylon, India (Cosmopolitan)

Larval form (*Cysticercus cellulosæ*) in pigs and man Ceylon, India (Cosmopolitan)

As the anatomy of the various species of *Tænias* is very similar, it is proposed to describe the type-species in some detail, and to restrict the descriptions of others to those characters in which they differ amongst themselves.

The worms attain a length of from 2 to 3 m, but may be even longer, they are composed of from 800 to 900 segments. The gravid ones attain a length of from 1 to 12 cm. by 5 to 6 mm in breadth. The genital pores are irregularly alternate, and are situated near the middle of the lateral margin of the proglottid. The neck varies in length from 5 to 10 mm.

Head The head is globular and has a diameter of from 600 μ to 1 mm. The rostellum bears a double crown of hooks varying in number from 22 to 32 (usually 26 or 28), the large ones have a length of from 160 to 180 μ and alternate irregularly with the small ones, which measure from 110 to 140 μ .

Muscular System This is well developed, and consists of circular muscles which divide the parenchyma into a cortical and a medullary part. Immediately external to the circular muscles there are a number of longitudinal bundles, the larger of which are situated nearest to the circular fibres, a second small layer of longitudinal fibres lies just beneath the cuticle. In addition, dorso-ventral muscle fibres are abundant.

Excretory System This consists of two main vessels running along each lateral margin, the ventral vessel is larger than the dorsal and is usually situated laterally to it.

Nervous System A single nerve runs longitudinally throughout the length of the worm along each margin laterally to the

excretory vessels , in addition, two minute nerves, one on each side, situated dorsally and ventrally to the main nerve, can usually be seen

Male Genitalia The testes are very numerous and occupy almost the whole of the medullary parenchyma between the excretory vessels The cirrus sac is comparatively small and reaches the ventral excretory vessel The cirrus is unarmed , the vas deferens is tightly coiled and runs from the cirrus sac almost in a straight line to near the middle of the segment

Female Genitalia The ovary is bilobed and situated posteriorly, the aporal lobe being slightly larger than the poral The vagina runs posteriorly to the vas deferens , near the

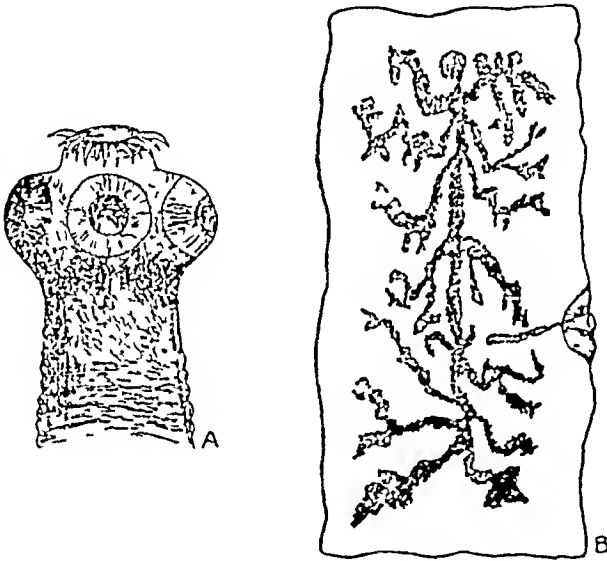


Fig 222 - *Tænia solium* A, head, $\times 30$,
B, gravid segment, $\times 6$ (Original)

middle of the segment it curves and passes behind the ovarian isthmus The vitelline gland is a short and broad gland situated behind the ovary, and it sometimes presents a bilobed appearance, its duct opens with that of the shell gland into the fertilization canal The shell gland is a small globular organ situated between the ovarian isthmus and the vitelline gland The fully developed uterus consists of a median stem with from 7 to 10 lateral compound branches on each side

This worm is of very great importance from both a medical and a veterinary point of view Man becomes infected with the adult worm through eating infected pig's flesh improperly

cooked In addition, if a man swallows the egg as a result of the pollution of water or vegetables it develops into the larval form (*Cysticercus cellulosæ*) A person harbouring the adult worm may also automatically infect himself with the larval form as a result of unclean habits, and further, it is stated that in some individuals the presence of the adult worm gives rise to such acute gastric disturbances that gravid segments are regurgitated into the stomach, which is equivalent to thousands of eggs being swallowed There is no part of the human body from which the larval form has not been recorded Its presence in the human eye or brain in particular is of very serious importance Normally, however, the larval form is found in the flesh of the pig, which becomes infected through swallowing eggs which have been passed in human fæces

C. cellulosæ attains the size of a pea, it consists of a colourless bladder containing a milky-white spot about the size of a pin's head, this being the head of the future worm When swallowed by man, the bladder is digested, the head is set free, and attaches itself to the wall of the intestine and buds off a chain of segments

(2) *Tænia saginata* Goeze, 1782 (Fig 223)

Synonyms numerous, amongst which are the following —

- Tænia solium* Linnæus, 1758 (*pro parte*)
- T. cucurbitina* Pallas, 1781 (*pro parte*)
- T. meinus* Biera, 1802, Moquin-Tandon, 1860
- T. lata* Pruner, 1847
- Bothriocephalus tiopicus* Schmidt-müller, 1847
- T. mediocanellata* Kuchenmeister, 1855
- T. (Cystotænia) mediocanellata* Leuckart, 1863

Adult worms in man only, Ceylon, India (Cosmopolitan)

Larval form (*Cysticercus bovis*) in cattle only, Ceylon, India (Cosmopolitan)

This worm is also of considerable medical and veterinary importance, because it is one of the common parasites of man The larval form occurs in the flesh of cattle

The worm may attain a length of several metres and a maximum breadth of 6 or 7 mm, it is composed of about 1000 segments, the gravid ones measure from 1 to 2 cm in length by about 7 mm in breadth The genital pores are irregularly alternate and situated near the middle of the lateral margin of the segment

The species is distinguished by the fact that the head does not bear hooks, it has a diameter of about 1.5 mm, the neck is rather long It resembles *T. solium* very closely, but differs from it in the following points —

- (1) It is larger and more fleshy
- (2) The head is unarmed

(3) The uterus consists of a central stem with from about 18 to 33 compound lateral branches on each side

(4) The larval form (*C. bovis*) occurs only in the flesh of cattle, so that the eggs of this species are not infective to man

In making a diagnosis of a human infection with a species of *Tænia*, the following points should be noted —

(1) The eggs of *T. solium* and *T. saginata* cannot be distinguished from each other, so that when eggs are found in the faeces one cannot say to which species they belong

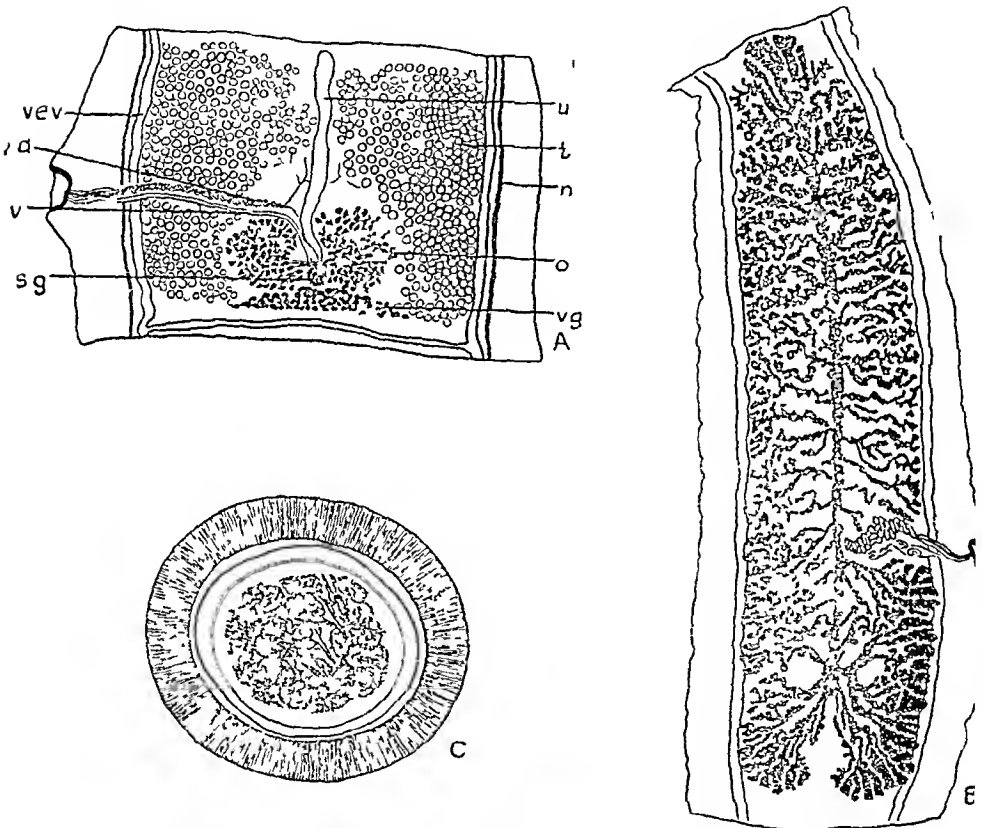


Fig 223 — *Tænia saginata* A, mature segment, $\times 7$, B, gravid segment, $\times 8$, C, *Tænia* egg, $\times 1000$ (Original)

(2) The head of *T. solium* and its larva is armed with hooks, whilst that of *T. saginata* and its larva is unarmed. A diagnosis can therefore be made easily if the head is available, but it is always difficult to obtain the head, and, from a medical point of view, when the head is obtained the necessity for making a diagnosis has usually passed

(3) The worms can be identified by the form of the uterus in the gravid segments which are normally passed in human faeces

In *T. solium* the uterus bears from 8 to 10 branches on each side, whilst in *T. saginata* the number is from about 18 to 33 on each side, in each case the branches are counted as they arise from the main stem. They can be counted easily with a hand-lens if the segments are washed in ordinary fresh water, pressed between two slides, and held up to the light, when the uterine branches show up a milky white.

(3) *Tænia hydatigena* Pallas, 1766

Synonyms — *Lumbricus hydropicus* Tyson, 1691
Hydra hydatula Linnæus, 1767
Vermis vesicularis eremita Bloch, 1780
Hydatigena orbicularis Goeze, 1782
Tænia marginata Batsch, 1786
Cysticercus tenuicollis Rudolphi, 1810

From dogs, Lahore Gaiger, Sondhi

Larval forms (*Cysticercus tenuicollis*) in (1) cattle, sheep, and camels (2) goats, Rangoon Meggitt (3) the four-horned antelope (*Tetracerus quadricornis*), Zoological Gardens, Calcutta Southwell (4) ² *Cervus arvis*, apparently Ceylon Shipley

The worm attains a length of from 75 cm to 5 m, the average size being 2 m, and consists of from 650 to 700 very fleshy segments. Gravid ones measure from 10 to 15 mm in length and 4 or 5 mm in breadth. The posterior margin of each segment overlaps the anterior margin of the succeeding one. In the gravid part of the strobila there is a tendency for a median longitudinal furrow to appear on the dorsal and ventral surfaces. It terminates posteriorly in a notch. The genital pores are irregularly alternate, quite inconspicuous, and situated near the middle of the lateral margin of the segment.

Head The head has a diameter of about 1 mm, the rostellum is armed with from 26 to 44 hooks, the large ones having a length of from 170 to 220 μ , and the small of from 110 to 160 μ .

Male Genitalia There are from 600 to 700 rather small testes distributed evenly over the dorsal surface of the segment, but not encroaching on the ovarian and vitelline areas. The vas deferens is loosely coiled and does not bear a seminal vesicle, it runs almost in a straight line from the cirrus sac to the middle of the segment and is often pigmented. The cirrus sac is cylindrical and measures about 450 by 130 μ .

Female Genitalia The ovary is bilobed, each part being almost circular, the aporal wing is distinctly larger than the poral. The vitelline gland is large and lies transversely behind the ovary. Between the vitelline gland and the ovary the conspicuous shell gland can be seen. From the pore the vagina

immediately dilates, and usually has a reflexed loop in the vicinity of the longitudinal excretory vessel, it runs to the middle of the segment and curves round to the mid-ovarian field, it is often pigmented black. The uterus consists of a central stem with from 5 to 10 stout, lateral, multiple branches on each side.

The young larva (*Cysticercus tenuicollis*) occurs embedded in the liver or free, older forms occur attached to the viscera, and especially to the mesenteries and in the abdominal cavity of oxen, pigs, sheep, etc.

(4) *Tænia echinococcus* (Zeder, 1803) Siebold, 1853 (Fig. 224)

Synonyms numerous, amongst which are the following —

Echinococcus granulosus (Batsch, 1786)

E. veterinorum Rudolphi, 1810

E. polymorphus Diesing, 1850

Echinococcifer echinococcus (Siebold, 1853) Wienland, 1861

Tænia echinococca Koeberle, 1861

T. (Echinococcifer) echinococcus Leuckart, 1863

T. (Athylostoma) echinococcus Diesing, 1864

T. (Echinococcus) echinococcus Railliet, 1885

From dogs, Lahore Gaiger, Sondhi Berhampur, Bengal Southwell

Larval forms (1) in the lungs of cattle, Colombo Southwell (2) Horses, cattle, sheep, and camels, India Gaiger. (3) Elephants, India Evans, Lecce

The worm measures about 4 mm in length and its maximum breadth is 500 μ . It is composed of from 3 to 5 segments, the last segment being somewhat longer than the rest of the worm. The first segment contains no genital organs, the second segment is mature, and the third is gravid.

The head bears from 28 to 50 hooks in a double crown, the largest hooks measuring 22 to 30 μ and the small ones from 18 to 22 μ . According to Leuckart, the large hooks measure 40 to 54 μ and the small ones 30 to 38 μ . In the mature segment there are from 40 to 60 testes, the ovary is horse-shoe-shaped with the concavity posterior, in this concavity the vitelline gland lies. The uterus differs from that of other species of *Tænia* in consisting of a tube which is more or less coiled. The larval form is a hydatid cyst found in most herbivorous animals, but principally in cattle. It has been recorded from practically every organ in the body, but shows a predilection for the liver. It also occurs frequently in man.

This worm is of great medical and veterinary importance, not because the presence of the adult worm in the dog gives rise to marked symptoms in that animal, but because the egg, when swallowed by either man or herbivorous animals, gives rise to hydatid disease.

Attention has been called to the fact that the worm is extremely small, measuring only 3 or 4 mm in length. It lies buried in the mucous membrane of the dog's small intestine.

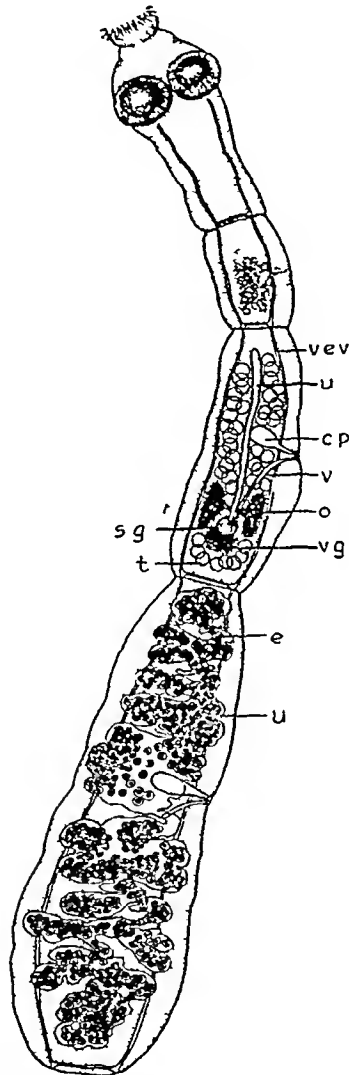


Fig 224 — *Tænia echinococcus* Entire worm, $\times 32$
(Original)

and *post mortem* can only be seen with difficulty, even when looked for by an experienced investigator.

The diagnosis of this worm in the intestine of the dog is a matter of great difficulty. In addition, it should be remarked

that several species of *Tænia* occur in the dog, the eggs of which cannot be distinguished one from the other. The diagnosis of *T. echinococcus* in the dog depends on finding the last (gravid) segment in the fæces to do this it is desirable that the dog's fæces should be mixed with fresh water and emulsified until of the consistency of porridge. Small quantities (about 1 c c) are then placed in a black developing dish and mixed with more water, when present, the last segment of the worm can be seen as a minute body which shows white against the black background. In the opinion of the writer, all dogs suffering from *T. echinococcus* should be destroyed and cremated at once, as they constitute a serious danger to man and domestic animals.

The larval form in cattle is a bladder, often the size of a cricket-ball. Multiple infections, especially in the liver of cattle, are common, and when the infection is extensive the cyst tends to be both smaller and sterile. The cyst is a colourless body full of fluid, when the fluid is drained off into a dish, a sediment (often referred to as "sand") settles to the bottom. This "sand" consists of an enormous number of heads, each of which, when swallowed by the dog, may become an adult worm in that animal. Sterile cysts are so called because they contain no "sand". Cattle and other herbivorous animals become infected with the hydatid cyst through swallowing eggs which have been deposited on pasture-land in the fæces of infected dogs and foxes.

Man becomes infected with the hydatid cyst in a variety of ways, e.g., pollution of water or green vegetables, or fondling infected animals, as a result of which eggs accidentally gain access to the mouth.

(5) *Tænia pisiformis* (Bloch, 1780) Gmelin, 1790

Synonyms — *Vermis vesicularis pisiformis* Bloch, 1780

Hydatigena pisiformis (Bloch, 1780) Goeze, 1782

Hydatigena utriculenta Goeze, 1782

Hydatigena cordata Batsch, 1786

Hydatigena utricularis Batsch, 1786

Vesicaria pisiformis (Bloch, 1789) Schrank, 1788

Tænia serrata canis domesticæ and *vulpis* Rudolphi, 1793

Cysticercus pisiformis (Bloch, 1750) Zeder, 1803

Tænia serrata Goeze, 1782

Tænia notella Neumann, 1896

? *Tænia polyculcaria* v. Linstow, 1903

From (1) Dogs, Lahore, Punjab Southwell, Gaiger.
 (2) *Canis aureus*, Museum Compound, Calcutta Southwell
 (3) *Felis tigris*, Burduar, Nepal Terai, Sevoke and Sukna, Darjeeling District Southwell (4) *Felis leo*, Zoological Gardens, Calcutta Southwell (5) *Felis pardus*, Wirawila, Antissa, South Ceylon v Linstow

Larval form (*Cysticercus pisiformis*) apparently not recorded from India

The worm attains a length of from 60 cm to 2 m, the average length being from 90 to 100 cm. It is composed of about 400 segments. The maximum breadth is about 5 mm. The terminal gravid segments attain a length of 1 cm and a breadth of 4 mm. The posterior lateral angles of all the segments are prominent, giving the strobila a serrate appearance. The genital pores are irregularly alternate, not prominent, and located near the middle of the lateral margin of the segment except in gravid ones, where they frequently lie well behind the middle of the lateral margin.

Head The head has a diameter of 1.3 mm, the rostellum is very powerful, sometimes $640\ \mu$ in diameter, and armed with a double crown of from 34 to 48 strong hooks. The large hooks measure from 225 to 294 μ , there being a strongly curved blade and a long handle. The small hooks measure from 132 to 177 μ in length, they have a strongly curved blade, a bifid guard, and a blunt distal extremity.

Male Genitalia There are from 400 to 500 testes in each segment, and they occupy all the field between the two excretory vessels except the space occupied by other genital organs. They extend between the two lobes of the ovary and posterior to the vitelline gland. The vasa efferentia open into a distinct seminal vesicle from which the vas deferens arises, this is much coiled, and reaches from the middle of the segment to the cirrus sac. The cirrus sac extends to the ventral excretory vessel and is surrounded by glandular cells.

Female Genitalia The ovary is bilobed, each lobe being reniform. The vitelline gland is a large, transversely placed organ situated behind the ovary. The shell gland is prominent, and is situated between the ovary and the vitelline gland. The vagina extends from the genital pore to the ovary in the form of a curve, its internal extremity being dilated into a rather prominent receptaculum seminis in the interovarian field. The uterus consists of a central stem with from 8 to 14 lateral compound branches on each side.

Under the name *Tænia polycalcara* Linstow in 1903 described a worm from the intestine of *Felis pardus* obtained from Wirawila, Antissa, South Ceylon. It had a length of about 108 mm and a maximum breadth of about 6.71 mm. All the specimens were immature, the reproductive organs being entirely undeveloped. The genital pores were irregularly alternate. The rostellum was armed with 38 hooks disposed in two rows. The large hooks measured about 238 μ in length and the small ones 158 μ . There can be little doubt that this species is identical with *T. pisiformis*.

The larva is a bladder worm (*Cysticercus pisiformis*) found in the liver, mesenteries, and, free or attached, in the abdominal cavity of rabbits and other rodents

Tænia sp Southwell, 1922

From *Felis tigris*, 'Zoological Gardens, Calcutta Southwell, 22 ii 16

It is almost certain that this worm is *Tænia pisiformis* (Bloch, 1780) Gmelin, 1790

(6) *Tænia multiceps* Leske, 1780 (Fig 225)

Synonyms — *Vermis vesicularis socialis* Bloch, 1780

Tænia vesicularis cerebri ma Goeze, 1780

Hydatigena cerebialis Batsch, 1786

Vesicularia socialis (Bloch, 1780) Schrank, 1782

Tænia cerebialis (Batsch, 1786) Gmelin, 1790

Polycephalus ovinus Zeder, 1803

Cœnurus cerebialis (Batsch, 1786) Rudolphi, 1808

Polycephalus cœnurus Tschudi, 1837

Tænia multipler Leuckart, 1852

Tænia caninus (Tschudi, 1837) Kuchenmeister, 1853

Multiceps multiceps (Leske, 1780) Hall, 1910

Multipler multipler (Leuckart, 1852) Liautard in Hall, 1911

From (1) Dogs, Lahore Gaiger (2) The jackal (*Canis aureus*), Zoological Gardens, Calcutta Southwell Larval form (*Cœnurus cerebialis*) in sheep and camels, Lahore Gaiger² (3) *Sus cristatus*, Rangoo, Burma Meggitt, who obtained "numerous cysticercoids from all parts of the body The majority of goats are infected" It appears almost certain that the forms recorded from the pig were specimens of *Cysticercus cellulosæ*, whilst those from goats were specimens of *Cysticercus tenuicollis* or *Cœnurus gaigeri* Hall, 1916

The worm attains a length of from 40 to 100 cm, and consists of from 200 to 250 thin, semitranslucent segments which have a maximum breadth of 5 mm The last gravid segment measures from 6 to 11 mm in length and about 4 mm in breadth The genital pores are irregularly alternate and are situated slightly behind the middle of the lateral margin of the segment

Head The scolex has a diameter of about 800μ , the rostellum is feebly developed and bears a double crown of from 22 to 32 hooks, the large ones measure from 150 to 170μ in length, the blade is only slightly curved, the handle straight in general direction but with sinuous borders and commonly notched dorsally The small hooks measure from 90 to 130μ in length, the blade is moderately to strongly curved, the handle long and tapering, usually curved, the convexity being dorsal, and the distal extremity is turned dorsally

Male Genitalia There are about 200 testes, confined principally to the lateral fields near the longitudinal canal and extending posteriorly to the vitelline glands. The vas deferens is closely coiled, running in the median direction from the cirrus sac to the central stem of the uterus. The cirrus sac extends from the genital sinus to the excretory vessels, it is sometimes curved, and measures from 315 to 350 μ in length by from 110 to 145 μ in breadth.

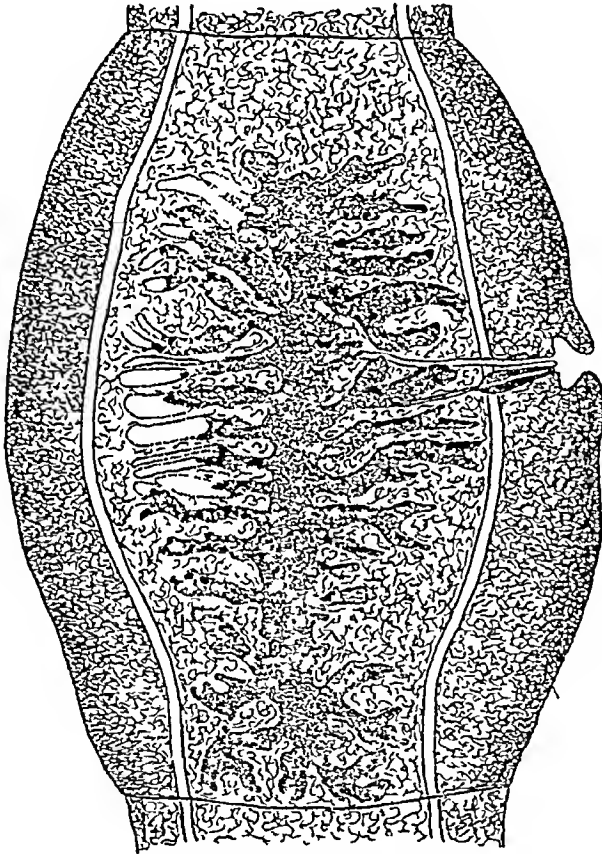


Fig 225 — *Tænia multiceps* Gravid segment, $\times 10$.
(Original)

Female Genitalia The ovary is bilobed, the two halves being rather widely separated, fan-shaped and equal in size. The vitelline gland is small, somewhat triangular, and at some distance posterior to the ovary. The shell gland lies between the vitelline gland and the interovarian field. The vagina possesses no peculiarities. The uterus consists of a central

stem with from 9 to 26 lateral compound branches on each side. A striking characteristic of this species is the almost constant interpolation of a uterine branch on each side between the ovary and the vitelline gland.

In *Canis aureus* the worms had a length of 7 cm. and a breadth of 4 mm. The head was armed with two rows of hooks, 15 in each row, the large ones measured $160\ \mu$ and the small $105\ \mu$. The uterins had 16 branches on each side. The genital pores were situated in the middle of the segment.

In specimens from *Felis pardus* mentioned below there were again 15 hooks in each row, the large ones measuring $155\ \mu$ and the small ones $116\ \mu$. This is the *Tænia* sp. recorded by Southwell in the Ann. Trop. Med. & Parasitol. 1922.

The larval form is a vesicle as large as a golf ball, filled with fluid, and containing a number of heads (about 150), each of which is easily visible to the naked eye and has a diameter of about 1.5 mm. These heads are peculiar in that they occur in clusters which occupy only a small part of the internal wall of the cyst, the rest of the cyst being clear, they never become detached from the wall of the cyst. The larva (*Cœnurus cerebralis*) occurs in the brain of sheep and cattle, and it is rarely found in any other situation.

It will therefore be realized that this worm is of considerable veterinary importance, and when dogs are infected with tapeworms a serious attempt should be made to ascertain whether this species is present or not, because if it is the infected dog is continuously spreading the "gid" disease amongst sheep, goats, and other potential hosts.

Tænia sp. Southwell, 1922.

From *Felis pardus*, Zoological Gardens, Calcutta. Southwell.

The worms measured only 1 cm. in length and $500\ \mu$ in breadth, they were quite immature. The large hooks measured 135 to $145\ \mu$ and the small hooks 90 to $100\ \mu$.

The writer now refers this species to *Tænia multiceps* Leske, 1780.

(7) *Tænia tæniæformis* (Batsch, 1786) Wolffthugel, 1911

Synonyms — *Vermis vesicularis muris* Hartmann, 1695

Fasciola muris hepaticæ Roederer, 1762

Tænia hydatigena Pallas, 1766

Vermis vesicularis tæniæformis Bloch, 1780

Tænia collo brevissimo Bloch, 1782

Tænia serrata Goetze, 1782

Hydatigena tæniæformis Batsch, 1786

Cysticercus fasciolaris Rudolphi, 1808

Tænia crassirollis Rudolphi, 1810

Tænia tæniæformis (Bloch, 1780) Stiles & Stevenson, 1905

Adult forms in (1) cats, Lahore Gaiger, Southwell, and Moghe Rangoon, Burma Meggitt (2) *Felis viverrina*, Zoological Gardens, Calcutta Southwell

Larval form (*Cysticercus fasciolaris*) in rats, Berhampur, Bengal, Civil Veterinary College, Calcutta Southwell

The worms measure from 50 to 60 cm in length and have a maximum breadth of from 5 to 6 mm Only extremely gravid segments are longer than broad The genital pores are inconspicuous and irregularly alternate, they are situated at the middle of the lateral margin of the segment The head is stout, cylindrical, and 1.7 mm thick The rostellum is armed with a double crown of from 26 to 52 hooks The large ones measure from 380 to 420 μ in length, the blade is slightly curved and the guard shows a tendency to be bifid The smaller measure from 250 to 270 μ in length, the blade is moderately curved and the handle is straight with a small distal enlargement

Male Genitalia The testes are numerous, closely packed, more or less lateral in position, leaving the central field almost clear, anteriorly, however, they extend across the segment They also reach posteriorly to the ovary, but do not pass behind the vitelline gland The vas deferens is closely coiled and extends almost in a straight line from the middle of the segment to the cirrus sac, the latter is slender and frequently curved in gravid segments In mature segments it measures from 430 to 475 μ and in gravid segments 300 to 345 μ In whole mounts it is difficult to see

Female Genitalia The ovary is bilobed, the polar lobe being smaller than the apical The vitelline gland is a somewhat irregular and conspicuous organ situated immediately behind the ovary The shell gland is very inconspicuous From the pore the vagina frequently presents a curved dilatation in the vicinity of the excretory vessels, and at this point is encircled by a well developed sphincter For the rest of its course it runs parallel with the vas deferens to a point near the middle of the segment and then curves between the ovarian lobes The numerous lateral branches of the uterus (17 or 18 on each side) are almost parallel with each other, but later on become sacculated, especially at their distal extremities

The larval form, known as *Cysticercus fasciolaris*, occurs in the body-cavity, liver, etc., of rats and mice It may attain a length of two or three inches and a breadth of 4 mm It frequently bears posteriorly a number of segments which, however, do not contain any genital organs.

(8) *Tænia serialis* (Gervais, 1847) (Fig 226)

Synonyms — *Cœnurus serialis* Gervais, 1847

Tænia serialis (Gervais, 1847) Baillet, 1863

Cœnurus cuniculi (Diesing, 1863) Cobbold, 1864

Cœnurus lowzowi Lindemann, 1867

Multiplex serialis (Gervais, 1864) Liautard, in Hal., 1911

From dogs, Lahore, Calcutta, and Angul, Orissa Southwell
Lahore, Gaiger, Sondhi

Larval form (*Cœnurus serialis*) not yet recorded

The larval form of this species normally occurs in the subcutaneous tissues of the rabbit. There are, however, no rabbits in India, although hares are plentiful. Gaiger, Dey, and Southwell separately recorded what they believed to be larval forms of this species from the connective tissues of the Indian goat, and Dey further recorded it from the brain of that

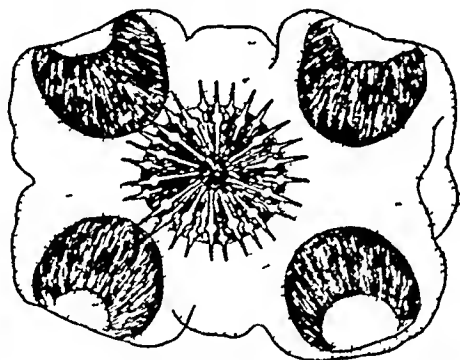


Fig 226 — *Tænia serialis* Head, viewed en face, $\times 59$
(Original.)

animal. Hall, however, considered that the larval forms recorded from the goat are not *T. serialis*, and he accordingly, in 1916, erected the species *T. gageri*, the adult form living in the dog and the larva in the brain and connective tissues of the Indian goat.

The worm measures from 20 to 72 cm in length and has a maximum breadth of 3.5 to 5 mm. It is very thick dorso-ventrally. The genital pores are prominent and are situated in various positions posterior to the middle of these segments. Mature segments are broader than long, whilst gravid ones are longer than broad and may measure from 6 to 12 mm in length by 3 to 4 mm in breadth. According to Hall, the one characteristic of this worm is the fact that the posterior margin of each segment overlaps the anterior margin of the next.

Head The head is almost spherical and measures from 850 μ to 1.5 mm in diameter. The rostellum bears from

26 to 32 hooks arranged in a double crown. The large ones vary in length from 135 to 175 μ , the blade is moderately curved and the handle sinuous in outline. The small hooks vary in length from 78 to 120 μ , the blade being strongly to moderately curved, the handle is short and curved and the guard bifid.

Male Genitalia The testes are very numerous, and at first do not invade the median field. Later, however, they extend into the median field and also occur posteriorly to the ovary. Immediately in front of the ovary there is a small field free from testes. The vas deferens is only slightly coiled. The cirrus sac is narrow and elongated, measuring from 200 to 300 μ in length by from 55 to 100 μ in breadth.

Female Genitalia The ovary is bilobed, immediately behind it is the somewhat transversely elongated vitelline gland. The shell gland is inconspicuous and is situated between the two lobes of the ovary. From the genital pore the vagina sometimes presents a reflex loop, or several loops, near the longitudinal excretory canal, and then curves gradually on its way to the ovary. The uterus consists of a central stem with from 20 to 25 lateral branches on each side which anastomose, it is therefore difficult to count them.

The larval form is *Cœnurus serialis* which is found in the subcutaneous tissue and lumbar muscles of rabbits and hares. It is apparently indistinguishable from the *cœnurus* of *T. multiceps*, which occurs in the brain of sheep.

Tænia ovis (Cobbold, 1869) Ransom, 1913

- Synonyms — *Cysticercus ovis* Cobbold, 1869
Cysticercus ovipariens Maddox, 1873
Cysticercus cellulosæ Kuchenmeister, 1878
Cysticercus tenuicollis Chatin, 1885
Cysticercus oviparus Leuckart, 1886

From dogs, Lahore Southwell

Larval forms (*Cysticercus ovis*) not yet recorded from India.

The worm measures 45 to 110 cm in length, with a maximum breadth of 6.5 mm, it shows a tendency to twist in the form of a spiral. The segments have convex lateral borders, and only gravid ones are longer than broad, the latter may attain a length of 1.5 cm and a breadth of from 3 to 5.5 mm. The genital pores are very prominent and are situated in the middle of the lateral margin of the segment. The pore may attain a diameter of 1 mm and an elevation of 750 μ .

Head The scolex is oblong and measures from 800 μ to 1.25 mm in breadth. The rostellum bears a double crown of from 24 to 36 hooks. The large ones measure from 156 to 188 μ in length, the blade is slightly curved, the handle narrow, rather long, and often with a well marked concavity.

on its dorsal border near the guard. The small hooks measure from 90 to 100 μ in length, the blade is sharply curved, the handle long, narrow, and tapering, with a tendency to turn ventrally at its distal extremity.

Male Genitalia There are about 300 testes, crowded together laterally and pressing on to the lateral margins of the ovary, but not extending posteriorly to it. In the median field they are more loosely scattered, and anteriorly to the ovary they leave a semicircular space. The vas deferens is thrown into a series of somewhat irregular loops, and occasionally a loop crosses the vagina. The cirrus sac measures from 450 to 550 μ in length and does not extend to the ventral excretory vessel.

Female Genitalia The ovary is bilobed, the aporal half being larger than the poral, both are of a loose open texture and are elongated transversely. The vitelline gland lies posteriorly to the ovary, is very elongated transversely, and is of a reticular structure. The shell gland is very small. The vagina usually follows a sinuous course, and either just clears the poral lobe of the ovary or crosses it, the latter being, according to Hall, a distinctive character of this species. The uterus consists of a central stem with from 20 to 25 compound lateral branches on each side.

The larva (*Cysticercus ovis*) is found embedded in the heart, voluntary muscles, oesophagus, lung, etc., of the sheep and goat.

(10) *Tænia retracta* Linstow, 1903

From *Canis eckloni* (? *Vulpes ferrilatus*), ? Tibet

Larval form not known

Doubt exists as to whether the host of this parasite was from Tibet. Linstow states that he obtained the worm from *Canis eckloni* (collection St. Petersburg Museum).

Baer (1925) gives the host as *Vulpes ferrilatus*, the Tibetan fox. The worm was immature and measured 550 mm in length. The head was armed with 34 hooks arranged in a double crown. The large hooks had a length of 308 μ and the small ones 211 μ . The number of uterine branches and the size of the egg are not known. The species seems closely related to, if not identical with, *T. pisiformis*.

(11) *Tænia gaigeri* (Hall, 1916)

Synonyms — *Cœnurus serialis* Gervais, 1847

Multiceps gaigeri Hall, 1916

From dogs, Lahore. Gaiger, Sondhi

Larval form (*Cœnurus gaigeri*) in the connective tissues and brain of Indian goats, recorded by Gaiger, Dey, and Southwell.

The worm varies in length from 25 to 182 cm, the average size being about 40 cm. The terminal segments measure about 14 mm in length and 2 or 3 mm in breadth, it is comparatively thin, delicate, and translucent. The genital pores are inconspicuous, irregularly alternate, and situated slightly behind the middle of the lateral margin of the segment.

Head The head has a diameter of about 1 mm. The rostellum is poorly developed, measures about $360\ \mu$ in breadth, and is armed with a double crown of from 28 to 32 hooks, the large ones measure from 160 to $180\ \mu$ in length, the blade is slightly curved, the handle nearly straight, with a dorsal notch, and the guard in lateral view is cordiform. The small hooks measure from 115 to $150\ \mu$ in length, have a strongly curved blade, and the handle is rather long and straight, tapering to a blunt tip. The guard has a median ventral depression, but is not bifid, it meets the handle at an obtuse angle. There is a short but distinct neck.

Male Genitalia There are from 200 to 225 rather large, irregularly spherical testes, confined principally to the lateral fields, they extend posteriorly as far as the vitelline gland. The vas deferens arises close to the median stem of the uterus and is densely coiled. The cirrus sac measures about $260\ \mu$ by from 100 to $125\ \mu$ and extends to the ventral excretory vessel.

Female Genitalia The vagina is bilobed, each lobe being fan-shaped, the two lobes are close together. The vitelline gland is somewhat triangular in outline, the apex extends into the inter-ovarian field, occasionally the gland is elongated, extending along the longitudinal axis of the segment. The shell gland is comparatively large and situated between the two lobes of the ovary. The vagina sometimes shows a reflexed loop near the excretory vessel, it then pursues a wavy course in a wide curve round the paravarian lobe to the mid-ovarian field. The uterus consists of a central stem with from 12 to 15 wide compound branches.

The larval form, *Cœnurus gaigeri*, is found in the central nervous system, internal organs, intermuscular connective tissue, under the peritoneum and subcutaneous tissues of the goat in India and Ceylon.

The adult worm is a parasite of considerable veterinary importance, and the remarks made with reference to *T. multiceps* apply equally to this species.

Worms incompletely described and of doubtful determination.

(1) TÆNIA MEANDER Linstow, 1903 (Fig 227)

From Schneider's leaf-nosed bat (*Hipposideris speoris*), Kalpitaya, Ceylon. ² Willey. Larval form not known.

The worm measures about 1.8 cm in length and has a maximum breadth, a little behind the middle, of 1.42 mm. All the segments are broader than long and the genital pores are unilateral. The strobila contains no calcareous corpuscles.

The longitudinal muscles are in two layers, the external layer consisting of bundles each containing two or three fibres and the internal bundles each containing from six to eight fibres. There are two longitudinal excretory vessels along each margin, one of which is markedly coiled. The scolex has a breadth of $130\ \mu$, the rostellum of $62\ \mu$, the latter bears, a little distance from its anterior end, a single row of 24 peculiarly shaped minute hooks, each of which measures about $9.1\ \mu$.

The number of testes is not known, but about 20 are visible in each transverse section. The cirrus sac is small and pyriform. The ovary lies in the central substance and consists of a number of groups of glands which spread out mostly



Fig 227 — *Tænia meander* Rostellar hook, magnification unknown (After Linstow)

on the aporal side. The receptaculum seminis reaches almost to the middle of the transverse section. The vitelline gland is in the middle of the segment and the shell gland is close to it.

The above is an abstract of Linstow's description of this species. The unilateral pores and the single row of small and peculiarly-shaped hooks indicate that it does not belong to the genus *Tænia*, the description is so inadequate that it is impossible to place it in any genus, but the shape of the hooks, which strongly resemble those of *Oligorchis paucitesticulatus* Fuhrmann, 1913, should enable future investigators to identify the worm with considerable certainty.

(2) *TÆNIA* sp Linstow, 1906

From *Haliaster indus* Bodd, Nedunkem, Ceylon ? Willey

(3) *TÆNIA* sp Southwell, 1922

From a dog, Lahore Southwell

(4) *TÆNIA* sp Southwell, 1922

From *Ursus torquatus*, Zoological Gardens, Calcutta Southwell

(5) *TÆNIA* sp (cystic form) Meggitt, 1927

From *Semnopithecus entellus*, Victoria Memorial Park, Rangoon, Burma Meggitt

A single cysticercus was obtained. The rostellum was armed with a double crown of alternating large and small hooks, measuring 370 to 400 μ and 260 to 280 μ respectively. The size of the hooks suggests that the species is closely related to *T. tæniæformis* (Batsch, 1786).

Family II ANOPLOCEPHALIDÆ Cholodkovsky, 1902

Scolex unarmed, without rostellum or accessory suckers. Segments broader than long. Genital organs single or double in each segment. Genital pores may be absent. Genital ducts generally pass dorsally to the excretory vessels, but may pass between them or ventrally to them. Testes numerous or few. Uterus tubular, reticulate or sac-like, it may become transformed into egg-capsules, or it may be replaced by one or more paruterine organs. Eggs with three envelopes, the inner one being chitinous and sometimes bearing a pyriform apparatus. Adults in birds, mammals, and reptiles. In no species of this family is the life-history known.

Type-genus — *Anoplocephala* Blanchard, 1848

Key to Subfamilies

Uterus persistent	<i>Anoplocephalinæ</i> , p. 25
Uterus developing paruterine organs	<i>Thysanosominaæ</i> , p. 49
Uterus breaks up into egg-capsules	<i>Linstowinaæ</i> , p. 58

The family is usually divided into four subfamilies, viz., *Anoplocephalinæ* Fuhrmann, 1907, *Linstowinaæ* Fuhrmann, 1907, *Thysanosominaæ* Fuhrmann, 1907, and *Avitellinaæ* Gough, 1911. Baer has, however, recently revised the family and has united the latter two subfamilies into one, which he names *Thysanosominaæ*. He therefore recognises three subfamilies only.

Subfamily I ANOPLOCEPHALINÆ Fuhrmann, 1907

Genital pores double, unilateral or irregularly alternate, sometimes absent. Genital ducts pass dorsally to excretory vessels except in one case, in which they pass between them. Testes usually numerous, sometimes reduced to two per segment. Cirrus pouch well developed. Female genitalia in the oral half of the segment. Uterus tubular or reticulate, becoming sac-like later on. Adults in mammals and birds.

Type-genus — *Anoplocephala* Blanchard, 1848

Of the genera included in this subfamily, the following have been recorded from India —

(1) *Anoplocephala* Blanchard, 1848, (2) *Moniezia* Blanchard, 1891, (3) *Cittotænia* Riehm, 1881, (4) *Bertiella* Stiles & Hassall, 1902 = *Bertia* Blanchard, 1891, (5) *Aporina* Fuhrmann, 1902; (6) *Paronia* Diamare, 1900

Luhe (1910) erected the genus *Paranoplocephala* to accommodate worms resembling species of *Anoplocephala* in all details except that the genital pores were irregularly alternate instead of unilateral

Baer (1924) established the genus *Anoplocephaloides*, but the characters of this genus were almost exactly those ascribed to the genus *Anoplocephala*. The same author in 1917 placed his genus *Anoplocephaloides* as a synonym of the genus *Paranoplocephala* Luhe, 1910, but whereas Luhe included in his genus only those species with irregularly alternating pores, Baer emended the characters of Luhe's genus so that it included species with unilateral pores. As emended by Baer it is impossible to say whether a species with unilateral pores should be placed in the genus *Paranoplocephala* or *Anoplocephala*. It is therefore clear that the genus *Paranoplocephala* must be restricted so as to include only those species with irregularly alternating pores

Key to Genera

- | | |
|---|---------------------|
| 1 Each segment with a single genital pore | 2 |
| Each segment with two genital pores | 3 |
| 2 Pores unilateral | ANOPLOCEPHALA, p 26 |
| Pores irregularly alternate | 4 |
| 3 Large worms parasitic in sheep and cattle, eggs with pyriform apparatus | MONIEZIA, p 37 |
| Smaller worms parasitic in rabbits and hares, eggs with pyriform apparatus | CITTOTÆNIA, p 41 |
| Parasitic in birds, eggs without pyriform apparatus | PARONIA, p 46 |
| 4 Uterus extending laterally to excretory vessels eggs without pyriform apparatus | APORINA, p 45 |
| Uterus situated internal to the excretory apparatus | BERTIELLA, p 43 |

Genus I ANOPLOCEPHALA Blanchard, 1848

A single set of reproductive organs in each proglottis. Genital pores unilateral. Genital canals pass dorsally to longitudinal excretory vessels. Vaginal pore ventral to cirrus sac. Testes aporal or scattered uniformly throughout the proglottis. Female glands poral. Uterus a transversely elongated sac with pocket-like appendages anteriorly and posteriorly. Eggs with well developed pyriform apparatus. Adults in mammals and birds.

Type-species — *Anoplocephala perfoliata* (Goeze, 1782)

Key to Species

- | | |
|--|-----------------------------|
| 1 Parasites of Equidæ | 2 |
| Parasites of Elephantidæ | <i>A. manubriata</i> , p 36 |
| Parasites of Rhinocerotidæ | <i>A. gigantea</i> , p 32 |
| 2 Head with lappets | <i>A. perfoliata</i> , p 27 |
| Head without lappets | 3 |
| 3 Small worms usually less than 2 cm in length | <i>A. mamillana</i> , p 30 |
| Large worms up to 15 cm in length | <i>A. magna</i> p 30 |

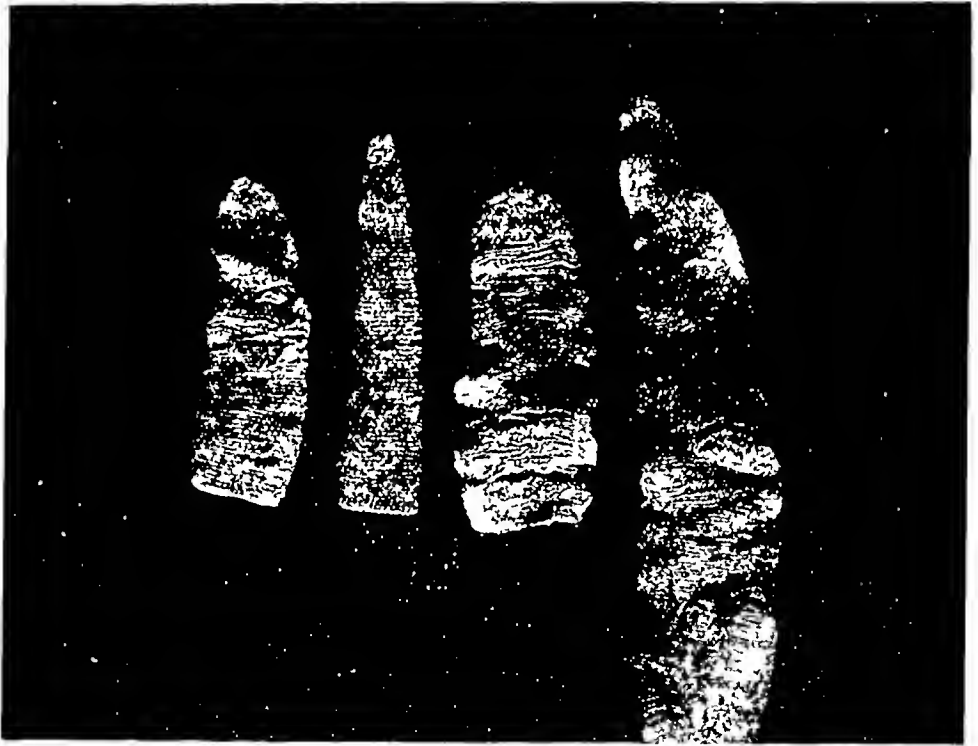


Fig 228 — *Anoplocephala perfoliata* Natural size (After Yorke and Southwell)

- (1) *Anoplocephala perfoliata* (Goeze, 1782) (Figs 228, 229, 230, 231, & 232 B)

Synonyms — *Tænia perfoliata* Goeze, 1782

Tænia equina Pallas, 1782

Tænia quadrilobata Abildgaard, 1789

From the horse, Lahore Gaiger

The worm attains a length of 7 cm and a breadth of 1.2 cm. The scolex is almost cubical and measures 3 mm in breadth

and 2 to 3 mm dorso-ventrally. The posterior part of the scolex bears four small lappets, two dorsally and two ventrally, situated one behind each sucker.

The longitudinal muscles are well developed, and are arranged in a large number of small bundles, disposed in a single layer. The dorso-ventral and transverse muscles are well developed. The excretory system is much ramified, and consists of two principal longitudinal vessels on each side.

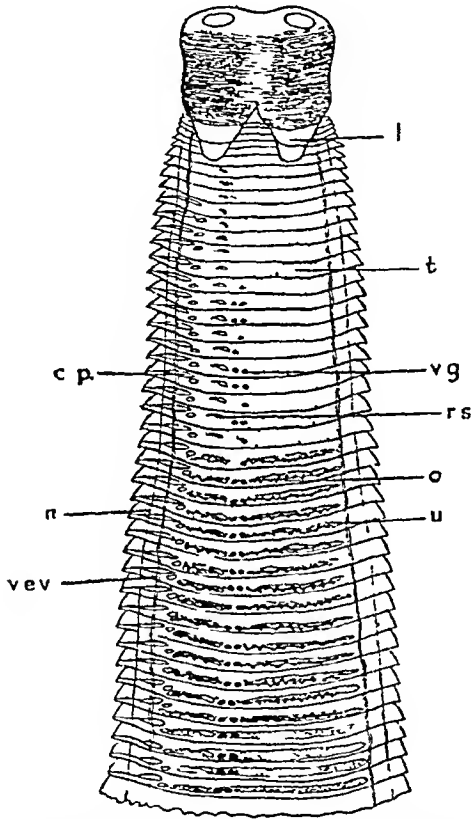


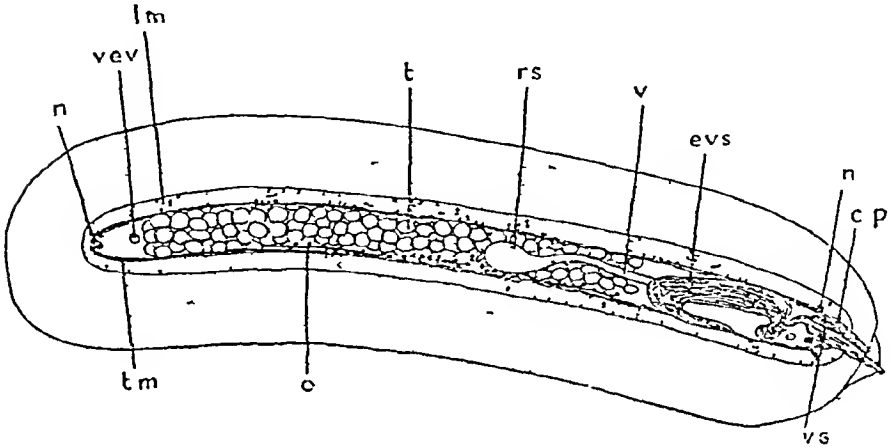
Fig. 229 — *Anoplocephala perfoliata*. In toto preparation of anterior end, $\times 6$ (After Yorke and Sothwell)

Male Genitalia There are about 200 testes distributed throughout the segment, disposed in two or three dorso-ventral layers. The external seminal vesicle is prominent, and the cirrus sac contains an internal seminal vesicle. The cirrus measures $450\ \mu$ in length, $200\ \mu$ in breadth, and is armed.

Female Genitalia The bilobed ovary is situated on the poral side of the segment. The aporal lobe is almost twice as large as the poral lobe. The vitelline gland is situated behind the

ovary in the poral half of the segment. The vagina opens behind the cirrus sac and dilates into an enormous receptaculum seminis. The uterus at first is a transverse tube which later on becomes sac-shaped and lobed, and finally fills the whole

DORSAL



VENTRAL

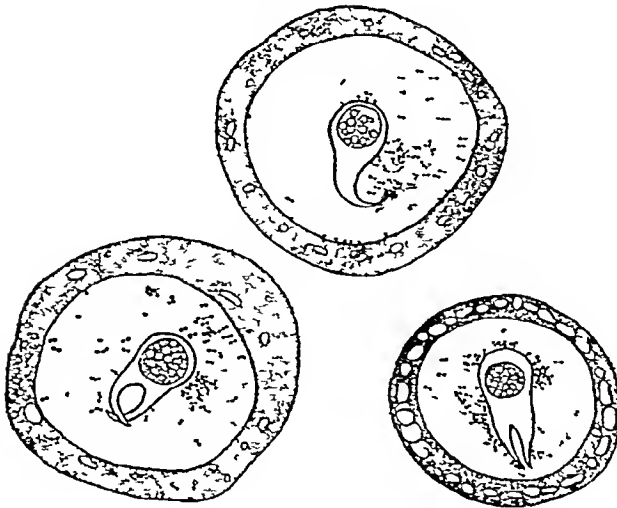
*Anoplocephala perfoliata*

Fig 230 —Segment, viewed posteriorly, showing male genitalia, $\times 15$.
(After Yorke and Southwell)

Fig 231 —Eggs, $\times 360$ (After Yorke and Southwell)

segment The egg measures about $80\ \mu$ in diameter and the oncosphere $16\ \mu$ It contains a well developed pyriform apparatus

(2) *Anoplocephala magna* (Abildgaard, 1789) (Fig 232 B)

Synonyms — *Tænia magna* Abildgaard, 1789
Tænia equi Mueller, 1780 *e p*
Tænia equina Pallas, 1781 *e p*
Tænia zebrie Rudolphi, 1808
Tænia phicata Rudolphi, 1810
Anoplocephala zebrie Railliet, 1891
Anoplocephala restricta Railliet, 1893
Anoplocephala phicata var *pediculata* Railliet, 1893
Anoplocephala phicata var *striangulata* Railliet, 1893
Anoplocephala phicata var *restricta* Railliet, 1893
Anoplocephala phicata var *senesi* Bounhiol, 1912

From the horse and donkey, Lahore and Calcutta Gaiger and Southwell

The worm measures up to 25 cm in length and has a maximum breadth of 2.5 cm The scolex has a diameter of 3 mm and appears globular The suckers have a diameter of $200\ \mu$

The longitudinal muscles are distributed in three layers and are occasionally segregated into bundles

The excretory system resembles that of *A. perfoliata*

There are from 400 to 500 testes filling the entire parenchyma and disposed in three or four dorso-ventral layers The cirrus pouch is long, but only $100\ \mu$ in breadth It is furnished with a strong retractor muscle The cirrus is also very long and is armed with spines Internal and external seminal vesicles are present

The ovary attains a breadth of 4.5 mm The vitelline glands and the ovary are in the poral half of the segment The gravid uterus fills the entire segment The egg measures 70 to $80\ \mu$ and the oncosphere $12\ \mu$ A well developed pyriform apparatus is present

(3) *Anoplocephala mamillana* (Méhlis, 1831) (Fig 232 A)

Synonyms — *Tænia mamillana* Méhlis, 1831
Tænia globiceps Diesing, 1856
Anoplocephala globiceps (Diesing) Luhe, 1895
Anoplocephaloides mamillana (Méhlis) Baer, 1924
Paranoplocephala mamillana (Méhlis, 1831) Baer, 1927

From the horse, Lahore Gaiger

Baer (1927) places this species in the genus *Paranoplocephala* Luhe, 1910, the characters of which are — Worms of varying size Genital pores unilateral or alternating irregularly Genital ducts pass dorsally to excretory vessels and nerve Testes numerous, situated on the aporal side of the ovary,

but they may extend beyond the excretory vessels on the same side. Female genital glands situated in the poral half of the segment. Uterus a transverse tube which may extend beyond the excretory vessels on the ventral side, and become sac-like and lobed. Eggs with pyriform apparatus. Adults in rodents and *Perissodactyla*.

It is difficult to find any justification for placing the species *mamillana* in this genus.

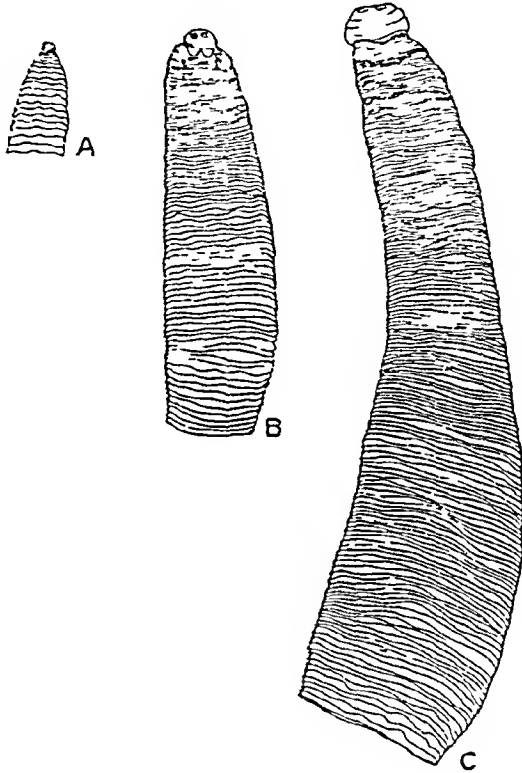


Fig. 232 — Outlines of A, *Anoplocephala mamillana*, B, *A. perfoliata*, and C, *A. magna*. Natural size (Original)

The worm attains a length of from 1 to 4 cm and a maximum breadth of 6 mm. Usually, however, it is much smaller and measures about 1.2 cm in length, 3 mm in maximum breadth, and contains 30 segments. The scolex is from 700 to 800 μ in diameter.

Male Genitalia There are from 60 to 100 testes disposed in several layers and situated in the aporal half of the segment. Both an internal and external seminal vesicle are present. The cirrus sac is well developed and pyriform, measuring from 800 μ to 1 mm in length. The cirrus is unarmed.

The female genitalia present no peculiarities. The vagina opens behind and ventrally to the cirrus sac and a large receptaculum seminis is present.

The relative size and appearance of the three preceding species of *Anoplocephala* are represented in fig. 232.

(4) *Anoplocephala gigantea* (Peters 1856) Blanchard, 1891.
(Fig. 233)

SYNONYMS — *Tænia gigantea* Peters, 1856
Tænia magna Mûre, 1870
Plagiotænia gigantea (Peters) Peters, 1871
Anoplocephala gigantea (Peters) Blanchard, 1891
Anoplocephala latissima Deiner, 1912
Schizotænia gigantea (Peters) Douthitt, 1915
Schizotænia latissima (Deiner) Douthitt, 1915
Anoplocephala vulgaris Southwell, 1921 (*Thysanosoma* sp. Southwell, 1916)
Anoplocephala magna var. *gigantea* (Peters) Baer, 1923
Plagiotænia latissima (Deiner) Stunkard, 1926
Plagiotænia vulgaris (Southwell) Stunkard, 1926
Plagiotænia longa Stunkard 1926

From (1) *Rhinoceros unicornis*, Janakpur, Nepal Terai, India Southwell (2) *Rhinoceros sondaicus*, locality unknown, specimens in Indian Museum.

This is the broadest cestode known, and apparently is a parasite common in both the African and the Asiatic rhinoceros. Stunkard (1926) re-established the genus *Plagiotænia* based on the large size of the worm, and so separated it from *Anoplocephala* and *Schizotænia*. It is evident that it belongs to the genus in which it is now placed.

The length of the worm is very variable owing to the fragility of its posterior part. It varies from 7 to 15 cm. in length and has a breadth of from 2 to 4 cm.

The MacCallums, however, have recorded a specimen at least 20 feet in length from the Javanese rhinoceros (*R. sondaicus*), whether or not the worm was of this species is not definitely known.

Scolex. The head is usually very small and there are no lappets. The four suckers are directed forward and slightly outward, and have a diameter of about 90μ , there is no neck. The lateral margins of the anterior segments curve forward so that the head rests in a deep depression between two shoulders, and can be seen only with difficulty with the naked eye.

Muscular System. This is poorly developed, the longitudinal bundles have a thickness of about 50μ and the annular ones of 15μ , a single bundle of muscle fibres connects the

segment 62. When fully developed they extend the whole distance between the aporal water vessel and the inner extremity of the cirrus sac. They are situated for the most part dorsally but extend ventrally, reaching the rudiment of the ovary.

The cirrus sac is first evident in segment 10, where it measures about $250\ \mu$ in length and $150\ \mu$ in breadth. The rudimentary external seminal vesicle can also be seen in this segment, lying immediately median to the cirrus sac. A few segments further back the cirrus sac has enlarged to $900\ \mu$ in length and its breadth is $275\ \mu$, it lies dorsally to the water vessel and nerve and gradually curves ventrally, until its internal extremity lies almost on the ventral surface. The outer seminal vesicle lies median and dorsally to the cirrus sac, it is a U-shaped tube having a diameter of about $40\ \mu$, the limbs of which lie close together, the inner limb gradually merges into the vas deferens, which narrows and pursues a wavy course along the dorsal surface. The inner seminal vesicle is first visible in segment 26 as a small club-shaped cavity near the internal extremity of the cirrus sac, it enlarges rapidly, and in segment 37 practically fills the entire pouch. The cirrus shortens as the inner seminal vesicle enlarges, and eventually disappears altogether, apparently it is unarmed.

A little further back the cirrus sac measures about 2 mm in length and has a breadth of $450\ \mu$. It remains this size in a number of segments and then gradually becomes straighter and narrower, persisting to the last segment. The outer seminal vesicle also enlarges enormously and alters its position accordingly, after which it gradually shrinks.

Female Genitalia. The ovary first appears in segment 19, it is situated ventrally and measures $45\ \mu$ in the dorso-ventral diameter. It attains its highest development a little further back, and disappears quickly. When fully developed, it extends laterally to within $650\ \mu$ of the aporal water vessel and to within $700\ \mu$ of the poral water vessel. The ovary is divided into two wings by the vitelline glands, the poral wing has a lateral diameter of about 2.2 mm and the aporal of 3.5 mm. The median axis of the ovary is very slightly on the pore side of the segment.

The ovary consists of a series of club-shaped acini arising from a ventral horizontal base, the larger acini measure about $470\ \mu$ dorso-ventrally and $60\ \mu$ laterally. They decrease in size towards the periphery of the ovary to a slight extent only. In segment 12 the vagina is well defined as a clear irregular tube having a diameter of about $70\ \mu$, and in segment 14 the receptaculum seminis is seen as a slight dilatation of the median extremity of the vagina. Both the

vagina and the receptaculum increase in size rapidly, and become enormously distended, in segment 29 the vagina has a diameter of about $450\ \mu$, and the receptaculum fills the whole dorso-ventral area. A few segments further back both these structures atrophy quickly. The vagina has the following relationship to the cirrus sac: from the genital pore it runs inwards, ventrally and posteriorly to the sac, but dorsally to the excretory vessel and nerve, it then crosses posteriorly to the cirrus sac and runs dorsally to it.

In the median direction the receptaculum is continued as a narrow tube, which is joined by the oviduct and continues in a dorsal direction as a long fertilization canal to the uterus. After the vitelline gland and receptaculum seminis are well developed they hide the other structures in the vicinity, but it was noted that the vitelline duct opens near the junction of the oviduct and fertilization canal, posteriorly and ventrally to the receptaculum seminis.

The rudiments of the vitelline gland appear with that of the receptaculum seminis in segment 8, and persist up to segment 100. The gland itself consists of two definite wings separated from each other and presenting a V-shaped appearance. The poral wing is smaller than the aporal wing, the former measuring about 370 by $200\ \mu$ and the latter 390 by $390\ \mu$, each is lobulated. Both wings lie on, but do not touch, the ventral surface.

The gland consists in segments 24 to 27 of a thickening on the wall of the fertilization canal which measures about 75 by $55\ \mu$, in posterior segments it appears to be absent.

A rudimentary uterus can be seen in segment 7 or 8. In segment 17 it consists of a very faint cell-string running midway between the dorsal and ventral surfaces. In segment 28 it runs between the ovary and the testes as a straight tube from one water vessel to the other. A little posteriorly it enlarges and its course becomes undulating. In succeeding segments the undulations become more pronounced, and still more posteriorly it presents the appearance of a number of vertical tubes, not always clearly separated from each other ventrally and dorsally, and containing immature eggs. Laterally, the extremities of the uterus remain straight and dilated. In the posterior segments the uterus fills the proglottid entirely, and dorso-ventral and antero-posterior muscular partitions can be seen with great clearness in whole segments or in sections viewed either end on, dorsally or ventrally. No sterile segments were observed.

Eggs The eggs enlarge and mature gradually in the posterior segments, the pyriform apparatus appearing last. The mature eggs in preserved specimens are of different shapes and sizes, a condition which appears to be dependent on

reciprocal pressure in the uterus. Extreme types are either ovoid or cuboid, the latter predominating, but intermediate types occur in abundance. In preserved specimens the following dimensions were obtained—Size of egg, 77 to 95 μ . Thickness of outer envelope, 16 to 18 μ . Diameter of embryo, 18 to 19 μ . Length of horns of pyriform apparatus, 18 μ . The free egg in the fresh condition is undoubtedly spherical. In immature ones the middle envelope lies close to the outer envelope. As the egg matures, the middle envelope gradually shrinks until it becomes a small mass, about 1 to 2 μ in diameter, attached to the filaments of the pyriform apparatus. Its size, therefore, cannot be given. The eggs contain numerous yolk-particles and granular material. The horns cross each other in very mature eggs, and each horn grows out into a long filament which becomes applied to the outer face of the vitelline envelope.

The segments drop off either singly or in clusters of two, three, or four. When single, they assume peculiar shapes.

(5) *Anoplocephala manubriata* Railliet, Henry, & Bouche, 1914.

From *Elephas maximus*, Toungoo, Burma. Meggitt.

This worm has a length of from 1.5 to 2.6 cm. and a maximum breadth of 1.5 cm. Railliet has since obtained fragments which had a breadth of 4 cm., and so one may reasonably assume that the worm attains a much greater length than that given above. The scolex is almost cubical, 6 or 7 mm. in breadth and 5 to 6 mm. dorso-ventrally. The excretory and muscular systems resemble those of *A. perfoliata*. The genital pores are situated in the anterior third of the lateral margin of the segment.

The very numerous testes are situated dorsally in a single layer, and occupy the whole segment between the water vessel. The cirrus sac is from 1.5 to 1.8 mm. in length and about 250 μ in breadth. A large external seminal vesicle is present. The ovary has a breadth of 1.5 mm., the vitelline gland is compact and situated in the middle of the segment. The vagina opens posterior to the cirrus sac, and is dilated into a rather large receptaculum seminis. The gravid uterus fills the entire segment and is lobulated. The egg contains a pyriform apparatus, it measures from 70 to 80 μ and the oncosphere from 17 to 22 μ .

?*Anoplocephala* sp.

Gaiger (1915) records a worm from a dog in Lahore, which he doubtfully refers to the above genus. It is, however, very improbable that the worm belonged to this genus.

Genus II MONIEZIA Blanchard, 1891

A double set of reproductive organs in each proglottis, with two reticulate uteri which may become more or less fused with each other in the median line. Genital ducts pass dorsally to the longitudinal excretory vessels. Interproglottidal glands usually present. Vagina ventral and cirrus dorsal on right side of segment, the reverse on the left. Eggs with well-developed pyriform apparatus, the horns of which generally end in a disc. Adults in mammals.

Type-species — *Moniezia expansa* (Rudolphi, 1810)

Key to Species

Interproglottidal glands circular

. *M. expansa*, p. 39

Interproglottidal glands linear

M. benedeni, p. 40.

Worms belonging to this genus occur principally in sheep, but they are also found, though less frequently, in the ox. In none of the species is the life-history known, but it is a fact of some significance that the worms occur most frequently and plentifully in lambs, whilst in old sheep they are very much less common. They are long worms measuring from 1 to 2.5 m. in length, having a maximum breadth of over 2 cm., and made up of hundreds of segments. In all the species the head is small and unarmed, and the segments, each of which has two genital pores, one on each lateral margin, are broader than long, except perhaps a few of the most mature. In colour they are creamy-white.

Until quite recently helminthologists distinguished the following species in domestic stock — *expansa*, *planissima*, *denticulata*, *alba*, *trigonophora*, *nullicollis*, *benedeni*, *neumannii*, and *oblongiceps*. These so-called species were supposed to differ from each other in one or more of the following points — Size, number, and position of testes, the form and the presence or absence of interproglottidal glands, etc. The species were placed in three groups, viz. —

- (1) Species in which the interproglottidal gland is absent — *alba* group. Including *M. alba* and *M. denticulata*.
- (2) Species in which the interproglottidal gland is a linear granulation, situated posteriorly in each segment, and parallel to the posterior margin — *planissima* group. Including *M. planissima*, *M. benedeni*, and *M. neumanni*.
- (3) Species in which the interproglottidal gland assumes the form of rings, situated posteriorly in each segment — *expansa* group. Including *M. expansa*, *M. nullicollis*, *M. oblongiceps*, and *M. trigonophora*.

Rudolphi (1804) described, under the name *Tænia denticulata*, a worm from the intestines of cattle. Practically nothing is known regarding the anatomy of this species, and Stiles (1893), after examining a few segments of Rudolphi's original worm, expressed the opinion that "an error had occurred in the label of Rudolphi's specimens, and that they were in reality leporine rather than bovine cestodes." This worm is now the type-species of the genus *Cittotænia*, and Baer (1927) states that it has the following synonymy —

Tænia denticulata Rudolphi, 1804, *T. goezer* Baird, 1853, *Cittotænia latissima* Riehm, 1881, *Diphidrium latissimum* (Riehm) Riehm, 1881, *Moniezia denticulata* (Rudolphi) Blanchard, 1891, *M. goezer* (Baird) Blanchard, 1891, *M. latissima* (Riehm) Blanchard, 1891, *Ctenotænia goezer* (Baird), Railliet, 1893, *C. denticulata* (Rudolphi) Stiles & Hassall, 1896, *C. denticulata* (Rudolphi) Stiles & Hassall, 1896

In 1810 Rudolphi, under the same name, described another worm from the intestine of cattle which is believed to differ in certain anatomical details from the species described by him in 1804, but it has not since been recorded. It undoubtedly belongs to the genus *Moniezia*, and appears to differ from other species of this genus in the fact that the genital pores are situated at the extreme posterior edges of the segments. Baer (1927) gives the following synonymy of this species —

Tænia denticulata Rudolphi, 1810, *T. alba* Perroncito, 1879, *Moniezia denticulata* (Rudolphi) Blanchard, 1891, *M. alba* (Perroncito) Blanchard, 1891, *M. alba* var. *dubia* Moniez, 1891, *M. amphibia* Linstow, 1901, *M. alba* var. *nova* Sauter, 1917, *M. alba* var. *longicollis* Sauter, 1917, *M. chappuisi* Baer, 1923

The interproglottidal glands can usually only be seen in stained specimens, and are subject to considerable variation. Recent workers have concluded that in reality there are only two species of *Moniezia* found in sheep and cattle, viz., those in which the interproglottidal glands are linear (sometimes only visible under high magnification), viz., *M. benedeni*, and those in which the glands are in the form of rings, viz., *M. expansa*. In both these species the genital pore is situated in front of the middle of each lateral margin of the segment. In *M. denticulata* Rudolphi, 1810, the genital pore is situated at the extreme posterior edge of the segment on each side. This morphological character is, in the opinion of the writer, sufficient to differentiate this worm from *M. benedeni*, and *M. expansa*, and I accordingly recognize these three species.

Sauter (1917) described a species under the name *M. conuogens* in which the interproglottidal glands were linear in the anterior segments of one strobila and ring-like in the

posterior segments of the same worm Theiler (1924) states that she has "never seen this arrangement, but, as the linear gland is often broken up into several smaller parts, I assume that this is what Sauter saw" If, however, Sauter's observations were correct, this fourth species could be identified without much difficulty

(1) *Moniezia expansa* (Rudolphi, 1810) (Fig 234)

Synonyms — *Tænia expansa* Rudolphi, 1810

Moniezia oblongiceps Stiles & Hassall, 1893

Moniezia trigonophora Stiles & Hassall, 1893

Moniezia minima Marotel, 1912

From (1) Ox and camel, India Gaiger, Leece (2) Sheep and goat, India Gaiger and Southwell (3) Black-buck (*Antelope cervicapra*), Zoological Gardens, Calcutta Southwell (4) Four-horned antelope (*Tetracercus quadricornis*), Zoological Gardens, Calcutta Southwell (5) Goat and camel, Burma. Meggitt

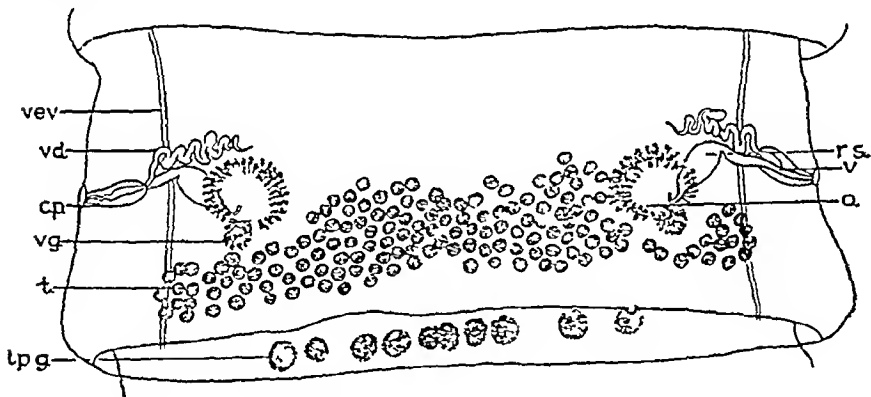


Fig 234 — *Moniezia expansa* Mature segment, $\times 27$
(Original)

The worm attains a length of from 4 to 5 m and a maximum breadth of 1.6 cm. The segments are practically always broader than long. The interproglottidal glands are grouped around blind sacs situated at the posterior margin of the segment. The number present in each segment varies from 6 or 7 to 30, and occasionally segments may be found in which they are entirely absent.

Muscular System The circular muscle fibres are scanty and loosely distributed, external to them are the longitudinal muscles, which are well developed and consist of a large number of fibres loosely segregated into bundles, sometimes presenting the appearance of two layers. Laterally the fibres

are not evenly distributed Dorso-ventral fibres are rather numerous, and even conspicuous in some parts of the strobila

Excretory System There are two longitudinal vessels on each side, the two ventral vessels being very small

The genital pores are situated slightly anterior to the middle of the lateral margin of the segment

Male Genitalia There are from 300 to 400 testes, their position is subject to considerable variation, but as a rule they occupy about the posterior two-thirds of the segment between the excretory vessels, and they extend in front to the level of the anterior margin of the ovary.

The cirrus sac is a pyriform or fusiform organ having a length of from 50 to 100 μ , which extends to the poral excretory vessels, immediately internal to it the vas deferens is thrown into one or two loose coils The cirrus is armed

Female Genitalia The ovary is bilobed, situated somewhat anterior to the middle of the segment and close to the excretory vessel Each lobe is prominent and fan-shaped Immediately behind it is the conspicuous vitelline gland

The vagina is a curved tube which, close to the ovary, dilates into a large receptaculum seminis

The uterus is single and reticulate Dorsally it extends on each side as far as the excretory vessels The egg measures about 60 μ in diameter and contains a pyriform apparatus

(2) *Moniezia benedeni* (Moniez, 1879) Blanchard, 1891. (Figs 235 & 236)

Synonyms — *Tænia benedeni* Moniez, 1879

Moniezia neumanni Moniez, 1891

Moniezia planissima Stiles & Hassall, 1893

Moniezia triangularis Marotel, 1912

Moniezia conjugens Sauter, 1917

Moniezia crassicollis Sauter, 1917

Moniezia crassicollis var *nova* Sauter, 1917

Moniezia latifrons Sauter, 1917

Moniezia parva Sauter, 1917

Moniezia planissima var *lobata* Sauter, 1917

Moniezia pellucida Blei, 1920

Moniezia translucida Jenkins, 1923

From sheep, Lahore Southwell

The worm attains a maximum length of 4 m and a breadth of 1.6 cm It is composed of a very large number of segments, the posterior ones being fleshy and having a thickness of about 2 mm The genital pores are situated in the anterior quarter of the segment The head has a diameter of about 800 μ and the suckers a diameter of about 3 μ

There are about 500 testes in young segments these are sometimes arranged in the form of two triangles The cirru

sac has a length of about $300\ \mu$ and a breadth of $100\ \mu$. The female genitalia resemble closely those of *M. expansa*, described above. The egg contains a well-developed pyriform apparatus.

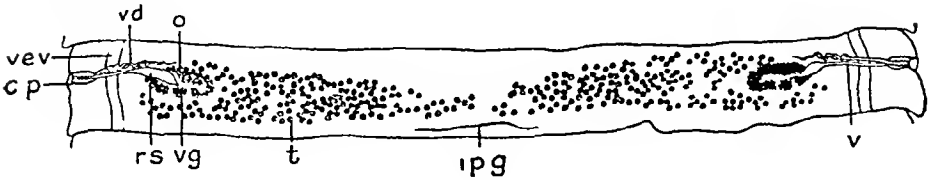


Fig 235 — *Moniezia benedeni* Mature segment, $\times 12$ (Original)

The interproglottidal gland is a narrow linear structure of varying size disposed transversely, close to the posterior margin of the segment.

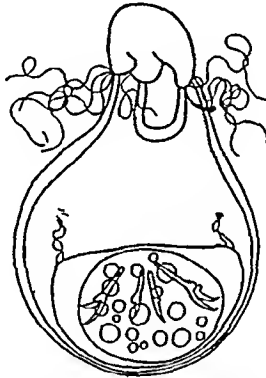


Fig 236 — Embryophore and hexacanth embryo from a *Moniezia* egg, $\times 770$ (Original)

MONIEZIA ALBA (Peironcito, 1879) Blanchard, 1891.

Southwell (1922) recorded this species from (1) the yak (*Bos grunniens*), Tibet, and (2) sheep, Lahore, Punjab, India.

The identity of this parasite is not absolutely certain, but it is undoubtedly either *M. expansa* or *M. benedeni*.

Genus III CITTOTÆNIA Riehm, 1881

A double set of reproductive organs in each proglottis. Genital ducts pass dorsally to longitudinal excretory vessels. Testes in an unbroken layer extending across the proglottis. Vagina ventral to cirrus sac on both sides of segment. Uterus single or double (one on each side of median line), trans-

versely elongated, tubular, generally with simple anterior and posterior club-shaped diverticula. Eggs with well-developed pyriform apparatus, the horns of which are long, crossing each other, or occasionally without pyriform apparatus. Adults in mammals and birds.

Type-species — *Cittotænia denticulata* (Rudolphi, 1804).

Cittotænia pectinata (Goeze, 1782) (Fig. 237.)

Synonyms — *Tænia pectinata* Goeze, 1782

Tænia marmotæ Frolich, 1802

Tænia leporina Rudolphi, 1810

Dipylidium pectinatum (Goeze) Riehm, 1881

Moniezia pectinata (Goeze) Blanchard, 1891

Moniezia marmotæ (Frolich) Blanchard, 1891

Ctenotænia pectinata (Goeze) Railliet, 1893

Ctenotænia marmotæ (Frolich) Railliet, 1893

Ctenotænia perplera Stiles, 1895

Ctenotænia variabilis, Stiles, 1895

Cittotænia marmotæ (Frolich) Stiles & Hassall, 1896.

Cittotænia variabilis (Stiles) Stiles & Hassall, 1896

Cittotænia variabilis angusta Stiles, 1896

Cittotænia variabilis imbricata Stiles, 1896

Cittotænia perplera (Stiles) Stiles & Hassall, 1896

Cittotænia quadrata Linstow, 1904

Cittotænia buisaria Linstow, 1906

Cittotænia mosaica Hall, 1908

From (1) *Lepus ruficaudatus*, Songara, Gonda District, United Provinces, India Southwell (2) *Lepus nigricollis*, Nedunkeni, Ceylon Southwell (3) Hare (*Lepus* ? *hispidus*); Berhampur, Bengal, India Southwell

This worm is extremely variable, as has been noted by Hall, Lymann, and Douthitt, and on this account the synonymy of the worm, as determined by Baer, is very extensive. It measures from 5 to 18 cm. in length and has a maximum breadth of from 1 to 1.5 cm. The genital pores are double in each segment and are situated either near the middle or on the anterior half of the lateral margin of the segment. The scolex varies in diameter from 300 to 800 μ .

The muscular system is well developed. The longitudinal muscles are in two or three layers of bundles. The circular and dorso-ventral fibres are numerous. The excretory system consists of two vessels running along each lateral margin, the ventral vessels anastomose with each other in the anterior part of the segment.

Male Genitalia There are from 60 to 150 testes, situated in a single dorsal field between and posterior to the two ovaries, and extending between the ovaries and the pores. The cirrus sac is very long, measuring from 400 to 900 μ in length and from 60 to 80 μ in breadth, the cirrus is also long and unarmed.

The vas deferens is thrown into coils, inside the sac it dilates into an internal seminal vesicle

Female Genitalia The ovary is somewhat fan-shaped and has a diameter of from 600 to 650 μ . The vitelline gland lies immediately posterior to the ovary and has a diameter of about 200 μ . The uterus is single and consists at first of a transverse tube situated in front of the testes and extending laterally as far as the excretory vessels on the dorsal surface, later on it becomes sac-shaped and lobed. The egg measures from 50 to 60 μ in diameter and contains a well-developed pyriform apparatus

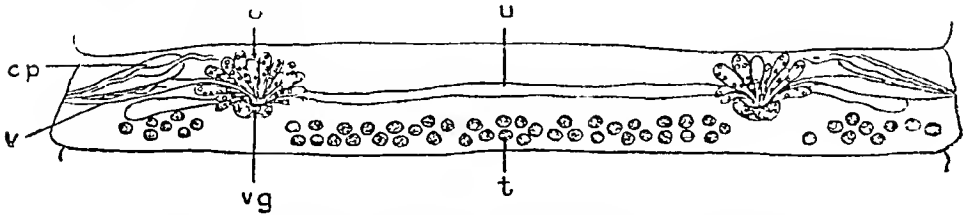


Fig 237 — *Cittotænia pectinata* Mature segment, magnification unknown (After Baer)

CITTOTÆNIA AVICOLA Fuhmann, 1897

Southwell recorded this species from *Lophophorus refulgens*, Zoological Gardens, Calcutta, and Meggitt doubtfully referred to the same species a worm which he obtained from Somett's jungle-fowl, Victoria Memorial Park, Rangoon. Southwell has re-examined his specimens, and after prolonged search with the oil-immersion lens, discovered a rostellum with innumerable hooks, each about 9 μ in length, very deeply retracted within the head. There can be no doubt that the worms are specimens of *Cotugnia margareta* Beddard, 1916, and it appears possible that Meggitt's worm from the jungle-fowl may also be the same species.

Genus IV BERTIELLA Stiles & Hassall, 1902

Worms of medium size, with a globular scolex. Genital pores irregularly alternate. Genital ducts pass dorsally to excretory vessels and nerve. Testes numerous, forming a continuous field limited by the excretory vessels. Cirrus sac slightly developed and containing a seminal vesicle. Ovary and vitelline gland situated in dorsal half of the segment. Vagina surrounded by a layer of glandular cells. Uterus a transverse sac situated between the excretory vessels. Eggs with a pyriform apparatus. Adults in primates.

Type-species — *Bertiella studeri* (Blanchard, 1891)

Bertiella studei (Blanchard, 1891) Stiles & Hassall, 1902
(Fig 238)

Synonyms — *Bertia studei* Blanchard, 1891
Bertia satyri Blanchard, 1891
Tania (Bertia) conferta Meyner, 1895
Bertiella studei (Blanchard, 1891) Stiles & Hassall, 1902
Bertiella satyri (Blanchard, 1891) Stiles & Hassall, 1902
Bertiella conferta (Meyner, 1895) Stiles & Hassall, 1902
Bertia polyorchis Linstow, 1905
Bertiella cercopitheci Beddard, 1911

From (1) *Simia satyrus*, Zoological Gardens, Calcutta Southwell. (2) *Hylobates hoolock*, Zoological Gardens, Calcutta Chandler

The worm varies in length up to 80 cm, but the average is from 25 to 35 cm, with a breadth of 1.5 cm. The scolex measures from 300 to 700 μ in diameter.

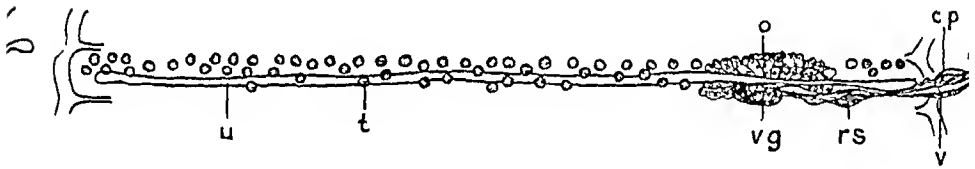


Fig 238 — *Bertiella studei* Mature segment, magnification unknown (After Baer)

The longitudinal musculature is composed of four layers of fibres disposed in small concentric bundles each containing from 25 to 30 fibres. The dorso-ventral and transverse muscles are well developed. The musculature varies widely in different worms and also in different regions of the same worm. There are four longitudinal excretory vessels, the ventral ones are larger than the dorsal, and are united by a rather prominent transverse vessel in the posterior part of the segment. On each side of the segment there is a main nerve and two accessory nerves. The genital ducts pass dorsally to the excretory vessels and nerve.

Male Genitalia There are from 150 to 300 testes in one or two layers occupying the whole width of the segment. Each testis measures from 60 to 100 μ . The vas deferens pursues a straight course before opening into the cirrus sac, this measures 400 to 600 μ in length and just reaches to the ventral vessel, it contains a vesicula seminalis. The cirrus is armed.

Female Genitalia The ovary is contracted, lobed, and situated in the poral half of the segment. It measures from

200 to 600 μ in breadth. The vitelline gland is small, kidney-shaped, and lies posteriorly and dorsally to the ovary. The vagina opens posteriorly and ventrally to the cirrus sac. It is surrounded throughout its length by a layer of glandular cells which are more developed in the distal region of the vagina. There is a large receptaculum seminis. The uterus at first appears as a transverse tube situated between the excretory vessels, when fully developed it fills the entire segment. The egg has a diameter of from 45 to 60 μ and the oncosphere of from 10 to 16 μ , the pyriform apparatus is well developed and its horns terminate in long filaments.

Genus V APORINA Fuhrmann, 1903

Worms of medium size. The genital pores, when present, are irregularly alternate, in some species they only occur in young segments, whilst in other species they are absent altogether. Genital ducts pass dorsally to excretory vessels and nerve. Cirrus sac small and slightly developed. Testes numerous, surrounding the female genitalia. The latter are situated in the poral half of the segment. Uterus a transverse tube which extends beyond the excretory vessels, and may bear diverticula, it later on becomes sac-like and lobed. Eggs without pyriform apparatus. Adults in birds.

Type-species — *Aporina alba* Fuhrmann, 1902

Aporina delafondii (Railliet, 1892) Brier 1927 (Fig 239)

Synonyms — *Tænia sphenoccephala* (Rudolphi) Mégnin, 1891, *ex parte*.
Tænia delafondii Railliet, 1892
Bertiella delafondii (Railliet) Fuhrmann, 1891
Bertiella delafondii (Railliet) Stiles & Hassall, 1902

From (1) pigeons (*Columba* sp.), Kasauli, India. Korke
 (2) *Platycercus pennanti*, Zoological Gardens, Calcutta. South well

This species has a length of 14 cm and a maximum breadth of 5 mm. The scolex has a diameter of 220 μ . The longitudinal muscles are composed of numerous small bundles which fill the cortical parenchyma. The transverse muscles are well developed and the dorso-ventral fibres are rather thick. The genital pores are irregularly alternate and open in the anterior third of the lateral margin of the segment.

There are about 100 testes, situated around the female genitalia, there being more on the aporal than on the poral side. The vas deferens opens into an external seminal vesicle before entering the cirrus sac, the latter is rather small and does not reach the excretory vessels on the poral side, it measures

only 80 μ in length and contains a rather large internal seminal vesicle. The cirrus is armed.

The ovary and the vitelline gland are situated in the poral half of the segment. The vagina lies posterior to the cirrus sac and opens into a rather large receptaculum seminis. The uterus is a transverse tube which later on, as it fills with eggs, becomes saccular and lobed. The egg has a diameter of 42 μ .

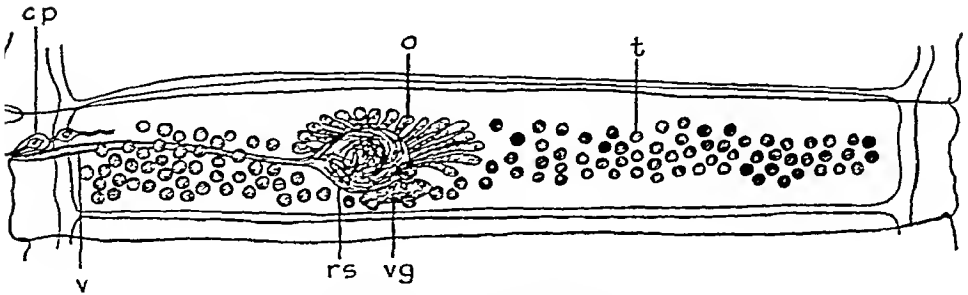


Fig 239 — *Aporina delafondi* Mature segment, magnification unknown (After Baer)

Genus VI PARONIA Diamare, 1900

Worms of medium size. Genital pores double. Two sets of genital organs in each segment. Genital ducts pass dorsally to the excretory vessels and the nerve. Vagina usually ventral to the cirrus pouch on both sides, but it is sometimes ventral on one side and dorsal on the other. Testes very numerous, forming a single dorsal and continuous field which sometimes extends beyond the excretory vessels. Uterus at first double, each horseshoe-shaped, later on developing numerous diverticula and becoming a single uterus. Eggs without pyriform apparatus. Adults in birds.

Type-species — *Paronia carrinor* Diamare, 1900

Linstow in 1888 obtained a worm from *Trichoglossus suavissoni* (Australia) which he named *Tænia trichoglossi*. His description was very imperfect, and he did not even state that the genital pores were double.

Diamare (1900) erected the genus *Paronia* to accommodate a double-pored cestode found in the Australian parrot *Cyclopsittacus suavissimus*. The type-species was *P. carrinor*. As Diamare's description was considered somewhat inadequate, Fuhrmann in 1901 placed the genus *Paronia* as a synonym of *Moniezia*, and at the same time he noted that *T. trichoglossi* Linstow, 1888, was identical with the *P. carrinor* Diamare. Nevertheless Fuhrmann considered *T. trichoglossi* as a *nomen nudum*, apparently the type-species of the genus should be *P. trichoglossi* (Linstow, 1888).

In 1902, under the name of *Monoxia columbæ*, Fuhrmann described a worm found in *Philonopus* sp and *Columba* sp. In 1918 he re-established Diamare's genus *Paronia* and referred the latter species to the genus *Paronia*. It differs from *P. carrinot* in minute details only.

Paronia columbæ (Fuhrmann, 1902) Fuhrmann, 1918 (Figs 240 & 241)

Synonyms — *Paronia carrinot* Diamare, 1900, *ex parte*
Monoxia columbæ Fuhrmann, 1912

From pigeons (*Columba* sp), Berhampur Bengal Southwell

Specimens which are gravid, but without heads, have a

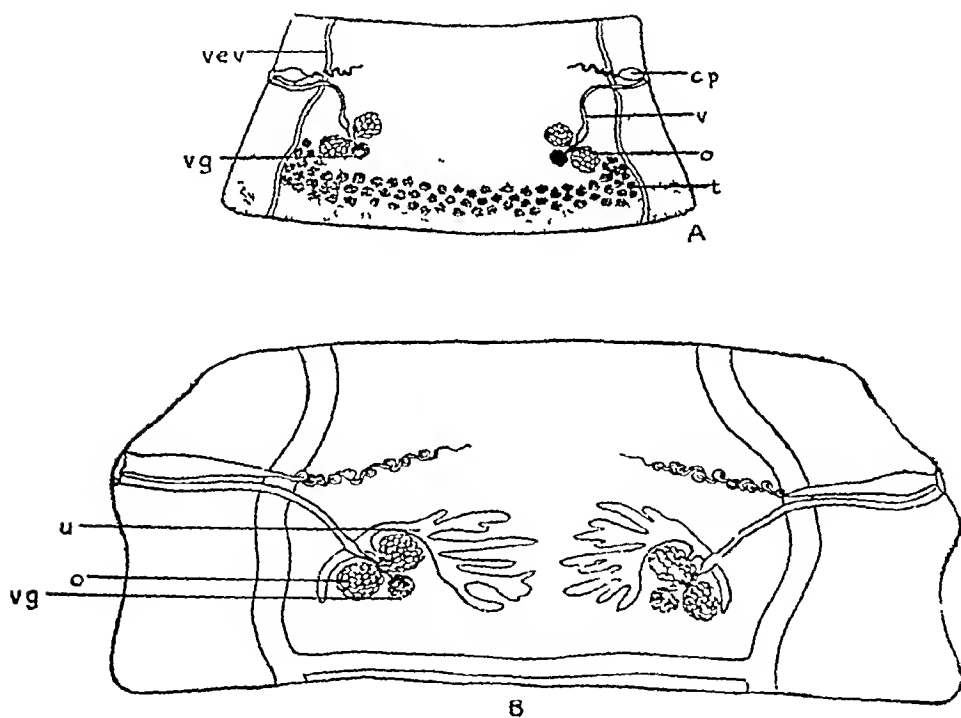


Fig 240 — *Paronia columbæ*. A, mature segment, $\times 27$, B, segment showing developing uterus, $\times 53$ (Original)

length of about 5 cm and a maximum breadth of 3 mm. Some of the posterior segments are a little longer than broad. The genital pores are double and are situated near the middle of the lateral margin of the segment.

The muscular system consists of two small layers of bundles, the inner one being the larger. The circular fibres are not well developed, but are disposed in three layers, viz., one internal, one external to the longitudinal muscles, and the third small layer between the inner and the outer longitudinal muscle bundles.

The excretory system consists of two longitudinal vessels on each side, the dorsal one being small and situated laterally to the larger ventral vessel. The latter vessels communicate with each other by a wide transverse branch situated in the posterior part of each segment.

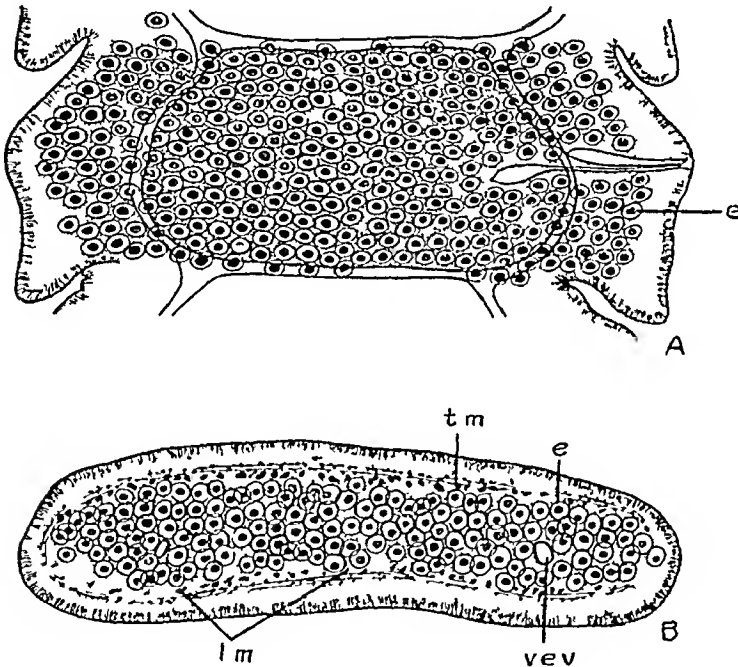


Fig 241 — *Paroma columbæ*. A, horizontal section of gravid segment, $\times 30$
B, transverse section of gravid segment, $\times 30$ (Original)

The testes are numerous (over 100) and are situated in the posterior half of the segment, they extend laterally as far as the ovary and ventral excretory vessel. The cirrus sac is anterior to the vagina and extends slightly internally to the ventral excretory vessel. The vas deferens is very short and strongly coiled.

The ovary is fan-shaped and consists of a number of tubular follicles, immediately posterior to it is a conspicuous vitelline gland. The vagina runs posterior to the cirrus sac, just

anterior to the ovary it dilates into a conspicuous receptaculum seminis. The uterus is at first double in each segment, it arises as a semicircular tube surrounding the ovary anteriorly on each side of the segment, from it numerous compound tubular outgrowths arise extending in the median direction, these enlarge and fuse with the outgrowths from the opposite side, the walls disappear, and eventually the uterus occupies the entire segment, extending laterally to the water vessels on each side. The egg has a diameter of about $75\ \mu$ and the oncospheres one of $25\ \mu$, a pyriform apparatus is absent.

Subfamily II. THYSANOSOMINÆ Fuhrmann, 1907.

Large worms. Genital pores double or single, in the latter case they are irregularly alternate. Genital canals dorsal to excretory vessels, or between them. Testes very numerous or few, in a single field or in two lateral groups. Female genitalia in dorsal half of segment. Vitelline gland may be absent, in which case the ovary contains the nutritive cells. Uterus tubular, may be very long and undulating. The paruterine organs may be very numerous or single. They each contain several eggs. Adults in ruminants.

Type-genus — *Thysanosoma* Diesing, 1835

It has already been noted that Baer has reunited the two subfamilies Thysanosominæ and Avitellinæ, the characters of which are given above. The subfamily contains the following genera — (1) *Thysanosoma* Diesing, 1835, (2) *Stilesia* Railhet, 1893, (3) *Avitellina* Gough, 1911, (4) *Thysanrezia* Skrjabin, 1926 = *Helictometra* Baer, 1927, (5) *Ascotænia* Baer, 1927.

Key to Genera.

- | | | |
|---|---|-------------------|
| 1 | With a double set of genital organs in each segment | THYSANOSOMA, p 50 |
| | With a single set of genital organs in each segment | 2 |
| 2 | With one paruterine organ in each segment | AVITELLINA, p 53 |
| | With two paruterine organs in each segment | STILERSIA, p 50 |

No species referable to the genera *Ascotænia* and *Thysanrezia* have been recorded from India, and doubt exists regarding a species referred by Southwell to the genus *Thysanosoma*.

Genus I **THYSANOSOMA** Diesing, 1835

Worms of medium size. Posterior edges of segment fimbriated. Two sets of genitalia in each segment. Genital canals between excretory vessels and dorsally to nerve. Testes very numerous, occupying the whole of the posterior half of the segment between the two lobes of the ovary. No vitelline gland. Uterus a single transverse tube which becomes undulated and expels its eggs into numerous paruterine organs. Adults in ruminants.

Type-species — *Thysanosoma actinioides* Diesing, 1835

Southwell (1913) obtained a worm from *Rhinoceros sondaicus* which he tentatively referred to this genus, it proved to be a specimen of *Anoplocephala gigantea* (Peters, 1856) Blanchard, 1891.

Genus II **STILESIA** Raillet, 1893

Strobila thin and narrow, outer segmentation apparently always distinct. Longitudinal muscles always in a single layer in the cortex. A single set of genital organs in each segment. Testes in two rows. Cirrus sac ventral, and usually anterior to the vulva on both sides. Genital canals pass between the excretory vessels and dorsally to the nerve. Uterus single, but paruterine organs double in each segment. Parasitic in ruminants.

Type-species — *Stilesia s. obipunctata* (Rivolta, 1874)

Key to Species

- | | |
|---|---------------------------------|
| Vas deferens closely coiled between cirrus pouch and outer wall of ventral excretory vessel | <i>S. vittata</i> , p. 51 |
| Vas deferens not closely coiled between cirrus pouch and outer wall of ventral excretory vessel | <i>S. globipunctata</i> , p. 50 |

(1) *Stilesia globipunctata* (Rivolta, 1874) Raillet, 1893

Synonym *Tenua globipunctata* Rivolta, 1874

From (1) Sheep, Lahore. Gaiger and Southwell. (2) Goats, Kasauli. Southwell. Camel, Lahore. Leece.

The worms attain a length of about 60 cm. and a maximum breadth of 2.5 mm. Segmentation is distinct, all the segments are broader than long, and their posterior lateral corners are produced so as to overhang slightly the anterior lateral margins of the succeeding segment. The genital pores are irregularly alternate and situated near the anterior angles of the proglottides. The head is somewhat square and has a

maximum diameter of about $900\ \mu$. The ventral excretory vessel is large and is external to the smaller dorsal vessel.

The longitudinal muscles are well developed and consist of a single layer of small bundles limited internally by a conspicuous band of circular fibres. The testes are in two rows, one row of from 4 to 7 on each side being external to the ventral vessel. The cirrus sac is small and pyriform and is ventral to the vagina, it extends to the nerve. The vas deferens on the pore side after uniting with the apical vas deferens, dilates into a conspicuous seminal vesicle situated anteriorly to the testes. The ovary is somewhat globular, and lies immediately median to the ventral vessel. From the pore the vagina pursues a sinuous course to the ventral excretory vessel where it divides into two, one branch, the oviduct, going to the ovary, and the other, the uterine duct, running to the uterus. Eggs pass from the ovary via the oviduct and uterine duct to the uterus. The latter organ develops on the poral side as a globular organ immediately dorsal and close to the ovary, a similar uterine sac (at first solid) develops aporally in the same segment and these two globular organs become connected by a duct, so that the uterus assumes the form of an elongated dumb-bell. The narrow duct connecting these lateral dilatations of the uterus quickly atrophies, so that the dilated extremity becomes isolated in each segment. From each uterus a paruterine organ develops in the antero-median direction, and into this organ the eggs eventually pass. Vitelline and shell glands are absent, the eggs are few—about 30—and measure about 56 by $27\ \mu$ and the embryo $14\ \mu$.

It is open to doubt whether the worms recorded from India under the above name are actually of this species.

(2) *Stilesia vittata* Rulliet, 1896 (Fig. 242)

From sheep, Civil Veterinary Department, Lahore. Southwell.

This species has hitherto not been recorded from sheep or cattle, it occurs, as far as is known, exclusively in the camel and dromedary. It is almost certain that the bottle containing these specimens was wrongly labelled, the worms were probably obtained from a camel. The species attains a length of about 23 cm and a maximum breadth of about 13 mm. Segmentation is not very distinct to the naked eye but is unmistakable under low magnification. The genital pores are irregularly alternate and are situated in the anterior third of the lateral margin of the segment.

The longitudinal muscles are feebly developed, the bundles being very small and disposed in a single layer. The transverse muscles are also very feebly developed. There are two

excretory vessels on each side, the small dorsal vessel is situated internal to the large ventral one. In each segment there are about 7 testes along each lateral margin, each group of 7 being situated external to the ventral excretory vessel, & e, in the strobila the testes are in two rows, they do not atrophy until the paruterine organs are almost fully developed.

The ovary is a small, somewhat globular mass situated on the pore side of each segment between the ventral and the

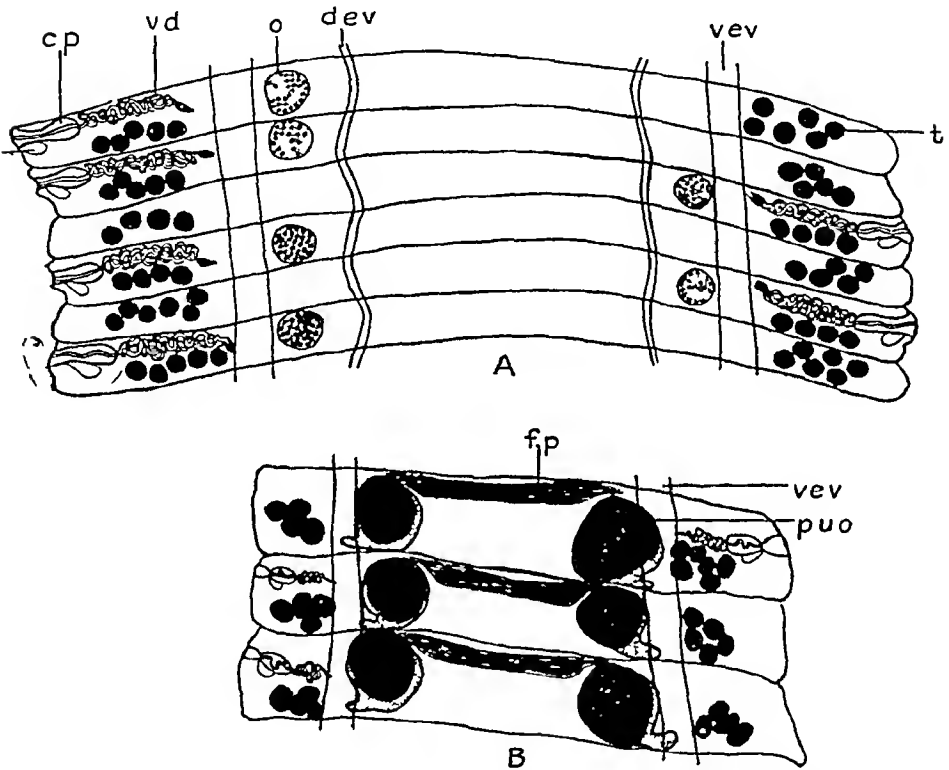


Fig 242 — *Stilesia vittata* A, mature segments, $\times 60$, B, gravid segments, $\times 60$ (Original)

dorsal excretory vessels, it only occurs in a very few segments, and quickly atrophies. The uterus is single in each segment, consisting of a transverse tube dilated at each lateral extremity, each dilatation being situated between the dorsal and ventral excretory vessels. The tube connecting these dilated extremities atrophies very rapidly, leaving a globular uterine cavity on each side of the segment. Within this uterus a paruterine organ develops, and into it the eggs pass.

This species resembles *S globipunctata* so very closely that Raillet considered it merely a variety. Apparently the chief point of difference between them is that in *S vittata* the vas deferens is thrown into a number of close coils between the cirrus sac and the excretory vessels.

Genus III AVITELLINA Gough, 1911

Strobila thin and narrow, outer segmentation either distinct or indistinct. Longitudinal muscles in a single layer in the cortex, a second smaller layer of subcuticular fibres may also be present. A single set of genital organs in each segment. Testes in two or four rows. Cirrus sacs dorsal or ventral to the vulvæ, and either anterior or posterior. Genital canals dorsal to both excretory vessels when two are present. Uterus and paruterine organ single in each segment. Parasitic in ruminants.

Type-species — *Avitellina centripunctata* (Rivolta, 1874)

Key to Species

- | | |
|--|--------------------------------|
| 1 Outer row of testes only one testis deep | <i>A lahorea</i> , p 55 |
| Outer row of testes more than one testis deep | 2 |
| 2 Paruterine organ resembles a bunch of bananas in shape | <i>A goughi</i> , p 57 |
| Paruterine organ pear-shaped | <i>A centripunctata</i> , p 53 |

Rivolta's description of *A centripunctata* from Italy was very inadequate. Gough (1911) gave a very full account, with figures, of what he believed to be *A centripunctata* (Rivolta, 1873) from sheep in South Africa. Woodland (1927) has concluded that the species described by Gough is almost certainly not the species originally described by Rivolta, and he has accordingly re-described, from material obtained from Italy, what he believes to be Rivolta's species, and further, he has referred Gough's specimens from South Africa to a species which he has named *A goughi*.

In view of the fact that Woodland has described a new species of *Avitellina* from sheep in India, viz, *A lahorea*, it is uncertain whether the records of *A centripunctata* (Rivolta, 1874) from sheep in India are correct.

- (1) *Avitellina centripunctata* (Rivolta, 1874) (Raillet, 1893)
(Fig 243)

From a goat, Civil Veterinary Department, Lahore Camel, Lahore Southwell Leece

The length of the worm is not known, but it probably attains about 250 cm, the maximum breadth is about 2 mm. The

segmentation is quite indistinct to the naked eye, and is not clearly defined even under high magnification. The genital

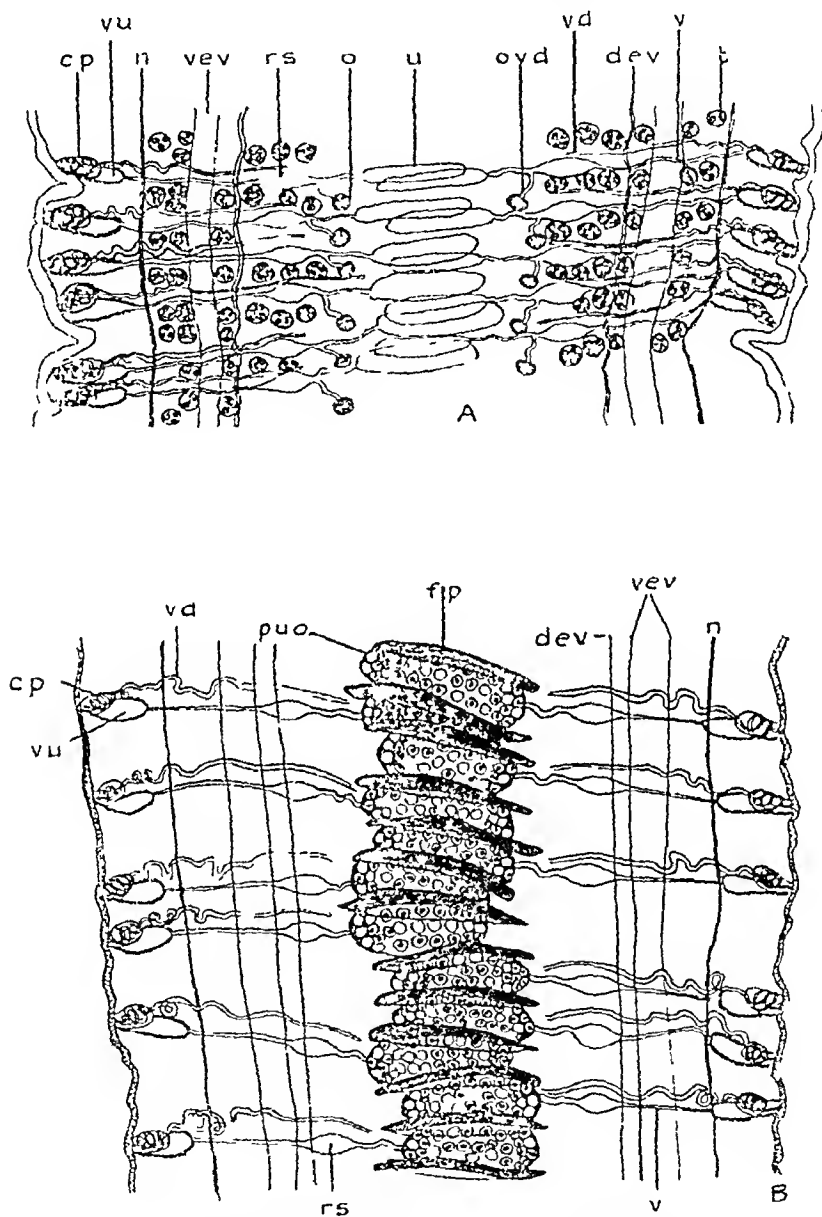


Fig 243 — *Anitellina centripunctata* A, mature segments, $\times 68$
B, gravid segments, $\times 68$ (Original)

pores are irregularly alternate and open near the middle of the lateral margin of the segment

The longitudinal muscles are definitely in two layers. The ventral excretory vessels on each side are well developed, they are situated externally to the minute dorsal excretory vessels.

The testes are in four rows along the strobila, viz, one row lateral and one row internal to the ventral excretory vessel on each side, the external row consisting of more than one testis.

The ovary is single in each segment and is situated internally to both excretory vessels not far from the middle of the segment. The vagina lies posteriorly to the cirrus sac on both sides of the segment, on the left side the vulva is dorsal to the cirrus sac, whilst on the right side it is ventral. The uterus is single in each segment and arises in the mid-longitudinal line, it is quickly replaced by a paruterine organ, which is limited anteriorly by a fibrous cap.

Attention has been called to the fact that Rivolta described this worm originally from sheep in Italy, and that his description was inadequate. Gough in 1911 gave a long and detailed description of *A. centripunctata* from sheep in South Africa. Woodland concluded that the species described by Gough was different from that originally described by Rivolta, he accordingly re-named Gough's species *A. goughi* and gave a full description of the worm, which he believed to be Rivolta's *A. centripunctata*.

(2) *Avitellina lahorensis* Woodland, 1927, (Fig 244)

From ? sheep or goat, Lahore. Woodland.

This species was described from two fragments of strobila without a head, which together measured 15 cm in length and had a maximum breadth of 1.94 mm, one fragment was immature and the other male mature. The gravid segments are not known. The margins of the semi-mature segments are smooth and slightly salient with segmental notches, the genital pores are irregularly alternate and situated near the middle of the lateral margin of each segment.

The longitudinal muscles are disposed in a single layer, the fibres being segregated into ill-defined bundles. A few longitudinal muscles lie scattered beneath the cuticle. Circular and dorso-ventral fibres are scanty. The excretory system consists of the usual two pairs of canals, one pair on each side, the ventral vessels being much larger than the dorsal, the former are situated mid-way between the paruterine organs and the margins, whilst the latter lie on the median side of, and close to, the former. The two lateral nerves lie one on each side just external to the outer row of testes. As in *A. centripunctata*, calcareous corpuscles are almost or entirely absent.

Male Genitalia The testes are in four rows, one on each side of each of the two ventral excretory vessels. The outer

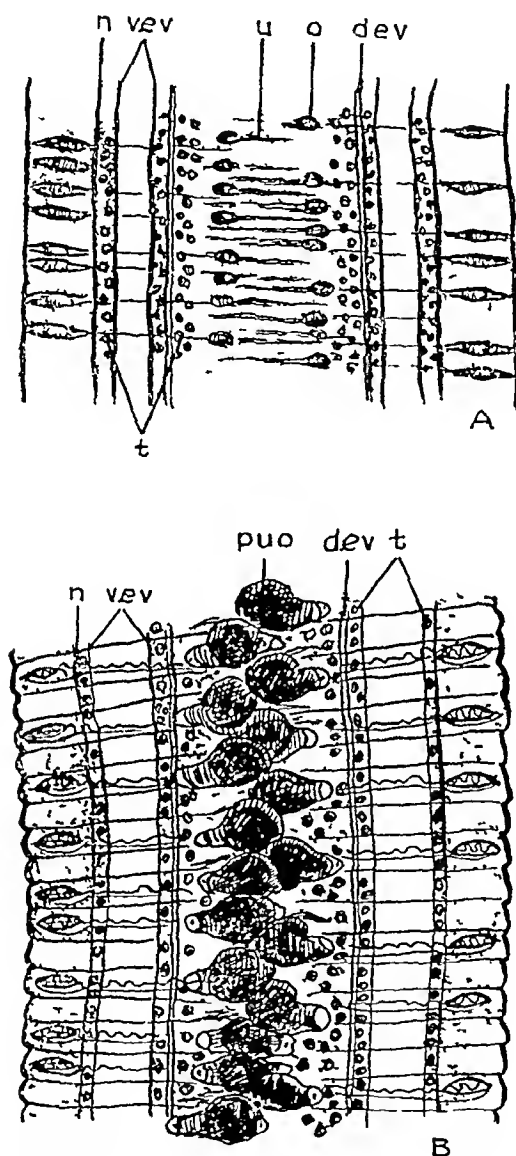


Fig 244 — *Auitellina lahorea*. A, mature segments, $\times 33$, B, gravid segments, $\times 33$ (After Woodland, in 'Parasitology')

row consists of a single testis on each side of each segment, the number of testes per segment is small, apparently about 6 or 7. The cirrus sac is oval in male mature segments, measuring about

128 by 55 μ , and extending about halfway between the lateral margin of the segment and the outer wall of the ventral canal, it contains several coils of the vas deferens, and opens along with the vulva, to a small genital atrium. In surface view the cirrus sacs lie anterior to the vulvæ, and on the right side the sacs are dorsal to the vulvæ, whilst on the left side they are ventral.

Female Genitalia The ovary is small, spherical, situated on the pore side immediately median to the small dorsal excretory vessel, and measures about 50 μ in diameter. The vagina terminates laterally in a dilatation called the vulva which opens into the genital sinus. The vulva is more elongate and narrower than the cirrus sac, and is covered with numerous glands. From its internal extremity the vagina continues as a narrow, more or less straight duct, and dilates into a globular receptaculum seminis, immediately internal to the ventral excretory vessel, from the receptaculum seminis the duct bifurcates, one branch running ventrally to the ovary and the other—a dorsal branch—to the paruterine organ. There is a single paruterine organ in each segment, situated in the middle of the longitudinal field of the strobila, the organ in one segment being slightly to the left and the organ in the succeeding segment slightly to the right of the mid-line, this alternation is, however, not strictly regular, there being sometimes two on the left side succeeded by one on the right side, another on the left two on the right, and so on. The size of the egg is not known.

(3) *Avitellina goughi* Woodland, 1927 (Fig. 245)

Synonyms — *Avitellina centripunctata* Gough, 1911
Stilesia centripunctata Meggitt, 1926

From (1) Cattle, Lahore Southwell (2) Sheep, Punjab Gaiger (3) Goat, Rangoon Meggitt

The worm measures up to 285 cm in length, and has a maximum breadth of (often near the head) from 1 to 4 mm. In life it has a gelatinous semi-transparent appearance, when preserved it tends to twist round its long axis. It is very thin dorso-ventrally and easily damaged. About 10 cm from the head an opaque milky-white mass (paruterine organ) appears in the centre of each segment. The head is unarmed, and the genital pores are irregularly alternate, one to each segment. The segments are all very short, especially in contracted specimens, their posterior lateral margins being salient.

The testes are in four rows, one to the right and one to the left of each of the large ventral longitudinal canals, the

dorsal vessel is extremely minute, and lies immediately median to the large ventral vessel

In the genus *Avitellina* Gough states that the cirrus sac lies ventrally or dorsally, anteriorly or posteriorly to the vagina. He gives figures which "show the sagittal section through about nine sections, passing through four cirri and vaginæ, it will be seen that the utmost possible irregularity has been realised" Woodland attaches no importance to this observation, and states "that in the majority of cases in all *Avitellina* species the cirrus sacs on the left side of the strobila lie ventral to the vulvæ, and on the right side dorsal" Clearly the relation of these genital ducts to each other cannot be considered as definitely determined

The ovary is situated on the pore side of the segment. The uterus is single, and develops a single large paruterine organ

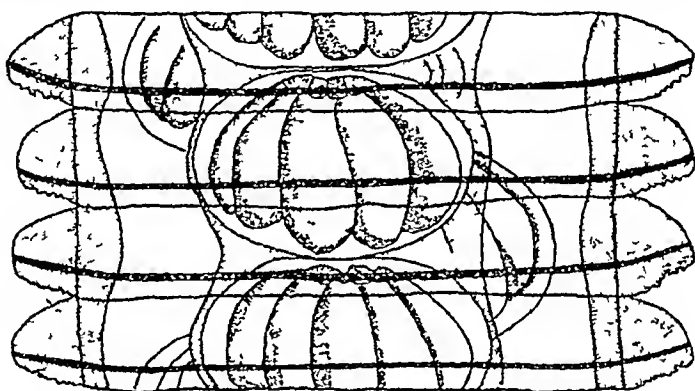


Fig 245 — *Avitellina goughi* — Gravid segment, $\times 99$
(After Gough)

resembling a bunch of bananas which lies in the centre of the segment, giving rise to the milky-white appearance noted above

Both vitelline and shell glands are absent. The egg measures about 40μ in diameter and the oncosphere 20μ . The embryophore does not bear a pyriform apparatus.

The life-history is entirely unknown.

Subfamily III LINSTOWINÆ Fuhrmann, 1907

Worms of variable size, segments often longer than broad. Genital pores double, irregularly alternate or unilateral, genital ducts pass either between, or dorsally or ventrally to the excretory vessels. Testes usually numerous, may be less than ten in number, cirrus sac small or large. Female genital organs median or in poral half of segment, uterus tubular,

resolving into a number of egg-capsules, each of which contains one or several eggs. Adults in mammals, birds, and reptiles

Type-genus — *Linstowia* Zschokke, 1899

Baer includes the following genera in this subfamily — *Linstowia*, *Oochoristica*, *Thysanotænia*, *Paralinstowia*, *Inermicapsifer*, *Multicapsiferina*, and *Pancerina*, of which only species of the first three genera have as yet been recorded from India

Key to Genera

- | | |
|---|--------------------|
| 1 Genital pores unilateral | THYSANOTÆNIA, p 68 |
| Genital pores irregularly alternate | 2 |
| 2 Genital ducts ventral to excretory vessels | LINSTOWIA, p 59 |
| Genital ducts pass between, or dorsal to, excretory vessels | OCHORISTICA, p 59 |

Genus I LINSTOWIA Zschokke, 1899

Worms of medium size. Scolex with suckers more or less pedunculated. Genital pores irregularly alternate. Genital ducts pass ventrally to the excretory vessels and nerve. Cirrus sac well developed. Testes numerous, forming a single field dorsal to the female genitalia, the latter are median. Uterus a transverse tube which becomes transformed into egg-capsules, each containing a single egg, the latter without pyriform apparatus. Adults in monotremes and marsupials.

Type-species — *Linstowia echidnæ* (Thompson, 1893)

Linstowia sp. Southwell, 1922

Two specimens without heads, apparently belonging to this genus, have been recorded from the lizard *Hemidactylus flaviviridis*, Calcutta. Southwell

Genus II OCHORISTICA Luhe, 1890

Worms of medium size. Adult segments often longer than broad. Genital pores irregularly alternate. Genital ducts pass between, or dorsal to, the excretory vessels. Testes usually numerous, but may be less than ten. Genital organs median. Uterus a transverse tube which may ramify, and which eventually resolves into oviparous capsules, each containing a single egg. Adults in carnivores, insectivores, edentates, marsupials, and reptiles.

Type-species — *Oochoristica tuberculata* (Rud., 1819)

It is impossible at present to provide a satisfactory key for the identification of the Indian species of this genus

(1) *Oochoristica cryptobothrium* Linstow, 1906) La Rue, 1911.)
(Fig 246)

From the tree-snake (*Chrysopelea ornata*), Kurunigala, Ceylon ? Willey

The worm attains a length of 13 cm and a breadth of 2.48 mm. The posterior segments are much longer than broad. The genital pores are irregularly alternate and are situated in the anterior third of the lateral margin of the segment. The cuticle is thick. The head has a diameter of about 600 μ and a terminal organ is absent. The neck measures about 2.3 mm in length. The longitudinal muscles consist of two layers of bundles, the inner one being very well developed. There are from 80 to 90 testes, situated dorsally in a single field and surrounded by the female glands posteriorly and laterally. The cirrus sac is spindle-shaped, measuring 80 μ in length by

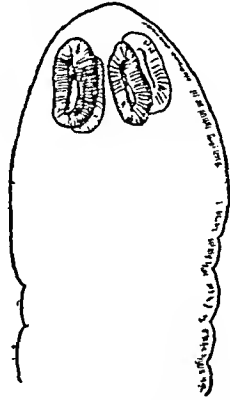


Fig 246 — *Oochoristica cryptobothrium* Head, magnification unknown (After Fuhrmann)

60 μ in breadth. It is furnished with a conspicuous retractor muscle. The vas deferens is thrown into a number of coils which extend to the middle of the segment. The ovary is bilobed and has a breadth of from 360 to 400 μ , it is surrounded posteriorly and laterally by the testes and is slightly asymmetrical. The vitelline gland is situated dorsal to the ovary and has a diameter of 160 μ . The vagina lies posterior to the cirrus sac, and a conspicuous receptaculum seminis is present. The shell gland is large and slightly ventral to the vitelline gland. The formation of the uterus and the disappearance of the ovary takes place very quickly in a few segments. The ventral uterine tubes very quickly lose their walls and the embryos are spread out in the parenchyma, where they lie singly in capsules, the capsules extend laterally beyond the excretory vessels and as far as the longitudinal nerves. The egg measures 52 μ and the oncosphere 20 μ .

(2) *Oochoristica agamæ* Baylis, 1919 (Fig 247)

From *Hemidactylus gleadowi*, Rangoon Meggitt

The worms measure 8 cm in length and have a maximum breadth of 1.5 mm. The cuticle is wrinkled, the posterior margin of one segment does not overlap the succeeding segment. The anterior segments are broader than long, when the uterus is fully developed the segments are square, and the more posterior ones gradually become much longer than broad. The genital pores are irregularly alternate and are situated a little in front of the middle of the lateral margin of the segment.

The scolex is devoid of a rostellum and has a diameter of about $650\ \mu$. There is a short neck.

Muscular System The longitudinal muscles are poorly developed, and consist of two layers, an inner of from

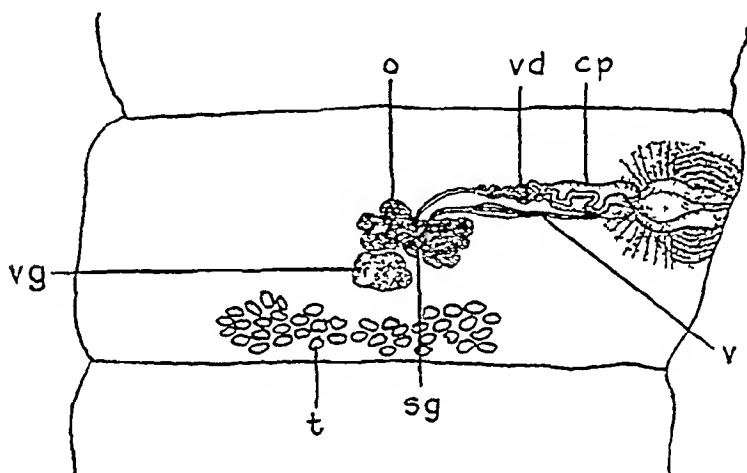


Fig 247 — *Oochoristica agamæ* Mature segment, magnification unknown (After Baylis, in 'Parasitology')

25 to 30 dorsal, the same number of ventral bundles, and a much smaller outer layer. Internal to the inner longitudinal layer small dorso-ventral fibres extend across the cortex and medulla.

Excretory System There are two longitudinal vessels on each side. The dorsal one is small and is usually situated almost directly above the ventral. From the latter numerous small lateral branches are given off which anastomose and form a network in the medullary parenchyma.

Male Genitalia There are from 39 to 46 testes, usually arranged almost in a straight series of three or four rows across the posterior part of the proglottis, but in elongated specimens

they may assume the form of a horse-shoe and surround the vitelline gland

The muscular genital atrium consists of a narrow dorsal portion and a large proximal cavity into which the cirrus opens

The cirrus sac is pyriform and measures about $150\ \mu$ in length and $80\ \mu$ in breadth. The vas deferens is much coiled distally. The genital ducts pass between the dorsal and ventral excretory vessels and dorsally to the nerve

Female Genitalia The ovary is butterfly-shaped and has a diameter of about $250\ \mu$. Immediately behind it is the vitelline gland. The bilobed ovary and the vitelline gland have the shape of a trefoil-leaf. Between these organs and situated dorsally, is the shell gland

The vagina enters the genital atrium posterior and somewhat ventral to the cirrus sac. Between the lobes of the ovary it forms a coil which functions as a receptaculum seminis. Along its course it dilates into a spindle-shaped swelling

The rudiments of the uterus can be seen in the 7th mature segment as a flattened sac situated ventro-anteriorly to the ovary. It rapidly develops egg-containing processes which eventually extend as far as the limits of the medulla. The ova thus becoming scattered throughout the parenchyma. When fully developed the egg measures $60\ \mu$ in diameter and the oncosphere $37\ \mu$

(3) *Oochoristica crassiceps* Baylis, 1920 (Fig 248)

From *Calotes versicolor*, Rangoon. Meggitt

The worms measure up to 7 cm in length; they have a maximum breadth of 1.3 mm and are composed of about 100 segments. The immature ones are much broader than long. Mature and early gravid segments are about twice as broad as long, and the last three or four proglottides are longer than broad. The genital pores are irregularly alternate and are situated in the anterior third of the lateral margin of the segment. The pore leads into a rather large atrium having a length of about $100\ \mu$. The cuticle is wrinkled and there is very little evidence of external segmentation, the division between the segments being marked only by a slight constriction. A neck is present, and measures 2.5 mm in length and $900\ \mu$ in breadth. The head has a breadth of from 1 to 1.1 mm, the scolex being rudimentary or absent. The suckers are not directed anteriorly but outwardly and are situated two on the dorsal and two on the ventral surface

Musculature The longitudinal muscles are in two layers, the inner layer separates the cortical from the medullary parenchyma and consists of from 20 to 30 bundles dorsally and the same number ventrally. The external longitudinal

muscles are situated in the thickness of the cortical parenchyma and consist principally of single fibres vaguely subdivided into two concentric series

Excretory System This consists of the usual four tortuous longitudinal vessels, two on each side, situated a little distance from the margin of the segment. One of them is a little larger than the other, but it is difficult to say which is the dorsal and which is the ventral, anastomoses are scanty or absent

Male Genitalia There are from 20 to 30 testes arranged in a single layer behind the ovary in the middle of the field in the posterior part of the segment

Baylis states that the cirrus sac is pyriform and measures

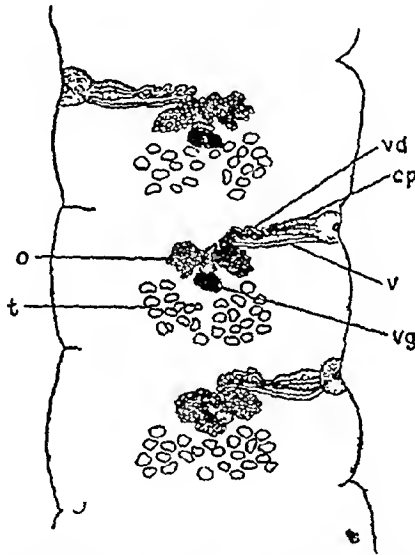


Fig 248 — *Oochoristica crassiceps* Mature segments, \times about 35
(After Baylis, in 'Ann & Mag of Nat Hist')

about 150 by 70 μ . According to Meggitt it varies in length from 15 to 19 μ . It is situated in front of the vagina in the same horizontal plane. The vas deferens is much coiled, and there is no specialized seminal vesicle.

Female Genitalia The ovary is the most anterior organ, and is situated in the median field slightly on the pore side. It is more or less distinctly bilobed, and has a transverse diameter of about 400 μ . The vitelline gland lies immediately behind it, and attains a diameter of about 100 μ . The shell gland is situated between the ovary and the vitelline gland. The genital ducts pass between the two excretory vessels. Assuming that the larger of these is, as is usual the ventral,

vessel, then the ducts pass ventral to the longitudinal nerve; this is, however, contrary to the arrangement obtaining in the other species of the genus. The vagina has a wide lumen for the greater part of its length. The distal portion probably serves as a receptaculum seminis. Just before reaching the female glands it narrows suddenly.

According to Baylis, it is probable that a uterus with a definite wall only exists in two or three segments, if at all, the ova from the first appear to be scattered at random in the parenchyma, without a definite enclosing membrane. Meggitt, however, states that the uterus, which at first is a lobed sac, later on becomes a complex reticulum, and finally breaks down into egg-capsules extending laterally to the excretory vessels.

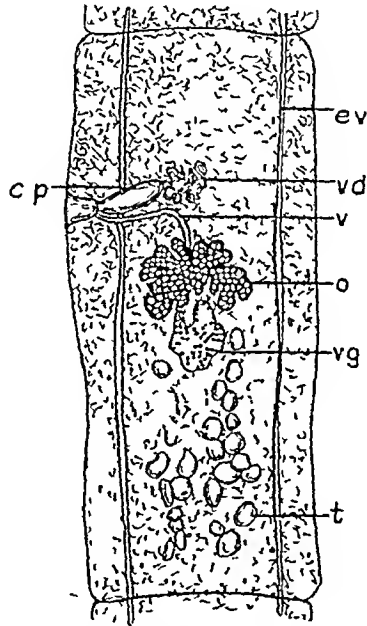


Fig 249 —*Oochoristica amphiseteta* Mature segment, $\times 78$
(After Meggitt, in 'Parasitology')

(4) *Oochoristica amphiseteta* Meggitt, 1924 (Fig 249)

From the mongoose (*Herpestes albopunctatus*), Rangoon
Meggitt

The worms have a length of from 1.5 to 4 cm and a maximum breadth of 450μ . The mature segments are much longer than broad, external segmentation not well defined, and often invisible posteriorly.

The head has a diameter of 210μ and bears four suckers, but no rostellum.

The musculature consists of a small inner layer of circular fibres, external to which is a single layer of longitudinal muscle bundles, in addition, a few scattered longitudinal fibres extend to the subcuticula

In gravid segments the dorsal longitudinal excretory vessel is absent. The rudiments of the genital organs are first visible about 5 mm behind the head. The genital pores are irregularly alternate and are situated at the junction of the first and second quarters of the margin of the proglottis. They show a tendency to become unilateral. There is a deep genital atrium extending almost to the longitudinal excretory vessel.

There are from 22 to 24 testes situated in the posterior half of the proglottis behind the ovary, the anterior ones being lateral and slightly posterior to the vitelline gland.

The cirrus sac is prominent, extending almost one-third across the proglottis. The cirrus is unarmed, the extensively coiled vas deferens, surrounded by prostate cells, lies immediately median to the cirrus sac.

The ovary is situated near the middle of the segment just posterior to the internal extremity of the cirrus sac, it is bilobed, each half being further subdivided. The vitelline gland is large, reniform, with a deep anterior notch, it is situated directly behind the ovary. There is no receptaculum seminis. The vagina is a simple curved tube devoid of any striking features. The eggs at first lie in groups in the ovary, subsequently they are found in groups in the parenchyma, and finally singly, in capsules, in the parenchyma, a few extend laterally beyond the longitudinal excretory vessels.

(5) *Oochoristica sigmoides* Moghe, 1926. (Fig 250)

From *Calotes versicolor*, Nagpur, Central Provinces, India
Moghe

The worm measures from 2.8 to 8.8 cm in length and has a maximum breadth of about 1 mm, the genital pores are irregularly alternate and are situated near the anterior corner of the lateral margin of the segment. A genital atrium, with thick muscular walls, is present. The genital ducts pass between the dorsal and ventral excretory vessels and dorsal to the nerve. The head has a breadth of about $210\ \mu$ and is entirely unarmed.

The musculature is weak and consists of an outer layer of scattered longitudinal fibres, an inner layer of longitudinal bundles, and internal to the latter a thin layer of transverse fibres. The dorsal excretory vessels are larger than the ventral, the vessels lie directly dorsal and ventral to each other, they disappear entirely in the posterior gravid segments.

Male Genitalia There are from 22 to 24 testes in two main groups, one on each side, but posterior to the corresponding

lobe of the ovary, posteriorly they are connected by a row of three or four testes situated behind the vitelline gland. The vas deferens is a narrow straight tube. The cirrus sac measures about 154 to $167\ \mu$ by 20 to $25\ \mu$, and extends internal to the excretory vessels, a portion of the vas deferens lies coiled within it.

Female Genitalia The ovary is bilobed, and each wing is divided into numerous finger-like lobes, it is situated in front of the testes, and is a large conspicuous organ. The vitelline gland is lobed and slightly aporal. The shell gland is situated immediately in front of the vitelline gland. The vagina runs parallel and posterior to the cirrus sac and vas deferens,

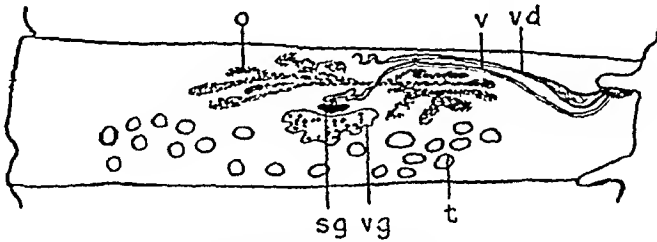


Fig 250 — *Oochoristica sigmoides* — Mature segment, $\times 45$
(After Moghe, in 'Rec Ind Mus')

enlarging in the vicinity of the ovary into an S-shaped receptaculum seminis. The uterus breaks up into capsules, each containing a single egg. The latter measures about $27\ \mu$ and the oncosphere $15\ \mu$.

(6) *Oochoristica figurata* Meggitt, 1927 (Fig 251)

From *Crociodura murina*, Rangoon Meggitt

The worm attains a length of from 11 to 16 cm and a maximum breadth of 1 mm. All the segments are at least twice as broad as long, the genital pores are irregularly alternate and situated almost at the extreme anterior angle of the margin of the proglottis, a shallow genital atrium is present.

The scolex has a diameter of $250\ \mu$ and resembles the head of species of *Inermicapsifer*, the suckers are directed anteriorly, and there is a transverse circular constriction separating them from the bluntly conical anterior portion. Immediately behind the head there is a pseudo-segmented portion which terminates with the appearance of the rudiments of the genital organs. The external segmentation of this part of the worm does not correspond to the internal segmentation, as two or three sets of genital rudiments may be present in what appears to be one proglottis.

Male Genitalia There are from 24 to 33 testes in two distinct equal groups, joined by from 3 to 5 testes all situated behind the female genitalia. The cirrus sac extends to the longitudinal excretory vessels.

Female Genitalia The ovary is bilobed, the two parts being joined by an extremely fine isthmus. Each half is further divided into a number of digitate processes, and the poral

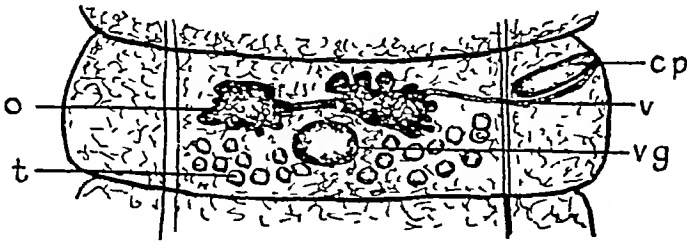


Fig 251 — *Oochoristica figurata* Mature segment, $\times 60$
(After Meggitt, in 'Parasitology')

lobe is larger than, and a little anterior to, the aporal one. The vitelline gland is situated slightly on the poral side. A uterus does not appear to develop, because the eggs arise suddenly in capsules even whilst the ovary is functional. The egg capsules are numerous, there being not less than 300; they extend to the cortex, and practically fill the segment.

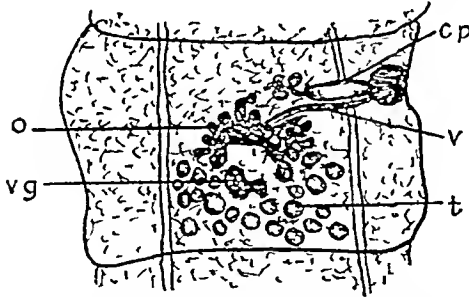


Fig 252 — *Oochoristica fibrata* Mature segment, $\times 80$
(After Meggitt, in 'Parasitology')

(7) *Oochoristica fibrata* Meggitt, 1927 (Fig 252)

From *Borga cyaneus*, Rangoon Meggitt

The worm measures from 7 to 9 cm in length and has a maximum breadth of 1.3 mm. The genital pores are alternating and situated in the anterior fifth or quarter of the margin of the segment. There is a large spherical genital atrium.

Male Genitalia There are from 35 to 36 testes situated posteriorly to the female glands and extending laterally to

the mid-line of the ovary The cirrus sac measures from 120 to 160 μ by 44 μ , in gravid segments it reaches to the longitudinal excretory vessels, but in mature segments it extends a third the distance across the segment, *i e*, median to the excretory vessels

Female Genitalia The vagina is situated posteriorly to the cirrus sac, the egg-capsules each contain a single egg, they lie between the longitudinal excretory vessels, occupying the entire proglottis, and penetrating the cortical parenchyma The species is closely related to *O agamæ* Baylis, 1919, from which it differs in the arrangement and smaller number of the testes and in the cortical extension of the eggs

Genus *THYSANOTÆNIA* Beddard, 1911

Worms of medium size Genital pores unilateral Genital ducts pass dorsally to the excretory vessels and nerves Cirrus sac well developed Testes numerous, situated on both sides of and behind the female genitalia Ovary and vitelline gland median Uterus resolves into parenchymatous capsules, each containing several eggs Adults in lemurs and marsupials

Type-species —*Thysanotænia lemuris* Beddard, 1911

Thysanotænia incognita Meggitt, 1927 (Fig 253)

From *Macropus ruficollis*, Victoria Memorial Park, Rangoon Meggitt

The worm attains a length of 5 cm and a breadth of 900 μ It is composed of a large number of segments, the posterior

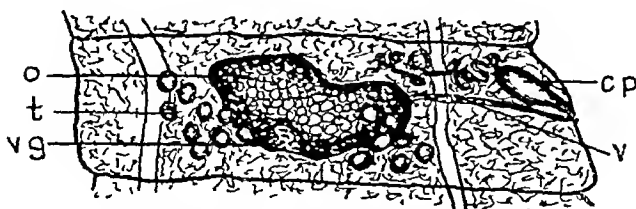


Fig 253 —*Thysanotænia incognita* Mature segment, $\times 80$
(After Meggitt, in 'Parasitology')

ones being longer than broad and resembling those of *Dipylidium caninum* The genital pores are unilateral and are situated in the centre of the margin of the segment, genital atrium practically absent The scolex bears neither hooks nor rostellum

Male Genitalia Testes in groups, 5 or 7 being poral and 11 to 15 aporal, they are not connected, but lie posteriorly to

the ovary and internally to the excretory vessels. The cirrus sac measures 180 to 210 μ by 70 to 100 μ , and extends to the longitudinal nerve. Its shape varies according to the degree of contraction, being sometimes cylindrical and sometimes pyriform, it contains a few coils of the vas deferens and apparently a large vesicula seminalis. The vas deferens is much coiled, the coils being situated either externally to or on the excretory vessels.

Female Genitalia The ovary is an irregular sac situated in front of the testes, and in mature segments occupies most of the proglottis between the excretory vessels. The primary uterus quickly disappears, the eggs passing at once into thin-walled capsules, each containing a single egg, which extend laterally to the excretory vessels.

Family III DAVAINIDÆ Fuhrmann, 1907

Scolex with a simple rostellum armed with one or more rows of very numerous hammer-shaped hooks. Suckers armed or unarmed. A single or double set of genital organs in each segment. Genital pores bilateral, unilateral, or alternating. Uterus persistent or not, in the former case sac-like, in the latter replaced either by numerous egg-capsules or by a single egg-capsule whose formation is preceded by the appearance of a paruterine organ. Eggs with thin transparent envelopes. Adults in mammals and birds.

Type-genus — *Davainea* Blanchard, 1891

Key to Subfamilies

Uterus persistent	<i>Ophriocotylinae</i> , p 114
Uterus breaks up into egg-capsules	<i>Davaineinae</i> , p 69

Subfamily I DAVAINIINÆ Braun, 1900

Rostellum armed with two rows (three in *Porogynia*) of hooks. Suckers armed or unarmed, in the former case with several peripheral rings of stable or unstable hooks. Uterus breaks down into numerous egg-capsules, each containing one or more eggs. Paruterine organ absent. Adults in mammals and birds.

Type-genus — *Davainea* Blanchard, 1891;

Key to Genera

- | | | | |
|---|---|---|--|
| 1 | Genitalia single
Genitalia double | 2 | |
| 2 | 4 to 15 segments, genital pores regularly alternate
Numerous segments, genital pores unilateral or irregularly alternate | | COTUGNIA, p 107
DAVAINEA, p 72
RAILLIETINA, p 74 |

Until recently this subfamily included the genera *Davainea* Blanchard, 1891, *Porogynia* Railliet & Henry, 1909, and *Cotugnia* Diamare, 1893. As the genus *Davainea* contained a very large number of species differing in important points from each other, Fuhrmann (1920) reclassified the species usually placed in the genus, as follows —

(1) *OPHRYOCOTYLOIDES* Fuhrmann, 1920. This genus embraces those species in which the uterus is persistent, sac-like, and lobed. Type-species — *Ophryocotylodes uniueterina* (Fuhrmann, 1909). Meggitt (1924) placed this genus, along with the genus *Ophryocotyle* Frus, 1870, in the subfamily Ophryocotylinae Fuhrmann, 1907.

(2) *DAVAINEA* Blanchard, 1891. Fuhrmann limited the characters of this genus so that it contained only species of the *proglottina* type. The characters of the genus are as follows — Proglottides few, 4 to 15, very small. Suckers very small. Neck absent. Genital pores usually regularly alternate, exceptionally irregularly alternate or unilateral. Cirrus sac large, extending considerably median to the excretory canals. Each uterine capsule with a single egg. Type-species — *Davainea proglottina* (Davaene, 1860).

(3) *DAVAINOIDES* Fuhrmann, 1920. Worms with from 6 to 20 longitudinal excretory canals. Strobila broad, non-gravid proglottides short. Testes numerous. Genital pores irregularly alternate. Each uterine capsule with a single egg. Type-species — *Davainoides vigintrasus* (Skrjabin, 1914).

(4) *HOUTTUYNIA* Fuhrmann, 1920. Strobila large. Rostellum with two rows of hooks and several series of spines. Suckers 2 unarmed. Genital pores unilateral. Testes very numerous. Female glands on poral side, each uterine capsule with several eggs. Type-species — *Davainea struthionis* (Parona, 1885).

(5) *RAILLIETINA* Fuhrmann, 1920. Synonym — *Bothriotænia* Railliet, 1892. Proglottides many, usually considerably more than 15. Suckers of medium size, with several rows of minute, persistent, or deciduous hooks. Genital pores unilateral or irregularly alternate. Scolex rounded, simple. Rostellum with a double (rarely single ?) row of hooks. Each uterine capsule with one or several eggs. Fuhrmann did not

designate a type-species, but Stiles & Orleman (1926) quote *R. tetragona* Molin, 1858 as the type by subsequent designation Fuhrmann subdivided the genus into the following subgenera —

(a) *PARONIELLA* Fuhrmann, 1920 With genital pores unilateral, egg-capsules each contain a single oncosphere Adults in birds and mammals Type-species — *Raillietina* (*Paroniella*) *longispina* (Fuhrmann, 1909)

(b) *RANSOMIA* Fuhrmann, 1920 With genital pores unilateral, egg-capsules each contain several oncospheres Adults in birds and mammals Type-species — *Raillietina* (*Ransomia*) *tetragona* (Molin, 1858)

(c) *SKRJABINIA* Fuhrmann, 1920 With genital pores irregularly alternate Egg-capsules each contain a single oncosphere Adults in birds and mammals Type-species — *Raillietina* (*Skrjabinia*) *cesticillus* (Molin, 1858)

(d) *JOHNSTONIA* Fuhrmann, 1920 With genital pores irregularly alternate Egg-capsules each contain several oncospheres Adults in birds and mammals Type-species — *Raillietina* (*Johnstonia*) *echinobothrida* (Mégnin, 1880)

Later (1924), in order to conform to the rules of zoological nomenclature, Fuhrmann altered the name of his subgenus *Johnstonia* to *Raillietina*, and gave as the type-species *R. crassula* (Rudolphi, 1819) Stiles & Orleman (1926) substituted the name *Fuhrmannetta* for the subgenus *Johnstonia* Fuhrmann, 1920, and *Raillietina* for *Ransomia* Fuhrmann, 1920

The genus *Houttuynia* Fuhrmann, 1920, was established to accommodate those species of Davameidæ in which the rostellum, in addition to being armed with the usual T-shaped hooks, bears a spiny collar, and in which the genital pores are unilateral and each egg-capsule contains several eggs In the table given below it will be obvious that the genus as at present defined cannot stand, because in at least two species in which the rostellum bears a spiny collar the egg-capsules each contain a single egg, the arrangement of the genital pores in these species being unknown In four other species the genital pores are irregularly alternate, but in two of these it is not known whether the egg-capsules contain one or several eggs It is therefore necessary either to emend the characters of the genus or subdivide it, as has been done in the genus *Raillietina*, or consider it invalid and merge the species in the genus *Raillietina* In this connection it is important to note that Meggitt states that in his species *R. birmanica* the spiny collar can only be seen when the parasite is alive, and this probably applies to other species as well

For the reasons given above the writer is unable to accept the genus *Houttuynia*

Table showing Species of Indian Davaineidæ in which the Rostellum bears a Spiny Collar

Species	Genital pores	No of eggs in capsules
<i>Raillietina</i> (R) <i>celebensis</i>	Unilateral	Several
<i>Raillietina</i> (R) <i>flabralis</i>	Unilateral	Several
<i>Raillietina</i> (R) <i>celebensis</i> var <i>paucicapsulata</i>	Unilateral	Several
<i>Houttuynia torquata</i>	Unilateral	Several
<i>Raillietina</i> (R) <i>birmanica</i>	Irregularly alternate	Several
<i>Raillietina</i> (F) <i>pseudoechinobothrida</i>	Irregularly alternate	Several
<i>Raillietina</i> (?) <i>reynoldsæ</i>	Not known	One
<i>Raillietina</i> (?) <i>fatalis</i>	Not known	One
<i>Raillietina</i> (?) <i>fluxa</i>	Irregularly alternate	Unknown
<i>Raillietina</i> (?) <i>indica</i>	Irregularly alternate	Unknown

Genus I DAVAINEA Blanchard, 1891

Strobila very small, consisting of from 4 to 15 proglottides
 Suckers small \ Musculature feebly developed Genital pores
 irregularly alternate Cirrus sac large, extending well beyond
 the longitudinal excretory vessels Testes relatively few Egg-
 capsules each contain a single egg Adults in birds, larval
 stages in molluscs

Type-species — *Davainea proglottina* (Davaine, 1860)

(1) *Davainea proglottina* (Davaine, 1860) R Blanchard, 1891
 (Fig 254)

Synonyms — *Davainea proglottina* var *dublanensis* (Kowal, 1894)
 Fuhrmann, 1905

Davainea varians Sweet, 1910 (= *dubius* Meggitt,
 1916)

From the domestic fowl, Rangoon Meggitt

The species appears to be very variable both in size and
 structure Possibly these variations are due to age, state of
 preservation, or to errors of observation

The worm measures about 4 mm in length and has a maxi-
 mum breadth of 600 μ They usually consist of from 4 to 6
 segments (² 9 occasionally), the posterior ones grow con-
 siderably in length even whilst attached to the strobila, and
 also subsequently This fact possibly explains the variations
 noticed in the length of the worm The genital pores are
 regularly alternate and situated near the anterior extremity
 of the segment The scolex is very small and armed with
 from 80 to 95 hooks, each measuring from 5 to 8 μ , in *D varians*,
 however, there are said to be from 44 to 50 The suckers are

armed with a few rows of minute rose-thorn-shaped hooks. The male genital organs are usually fully developed in the second segment and the ovary in the third segment, they both disappear quickly.

Male Genitalia The testes vary a little in number, there being usually 19 (Blanchard gives 22, Marotel 12 or 13), they are situated behind the female organs in the posterior half of the segment. The cirrus sac is rather large, extending almost to the middle of the segment. The cirrus is armed with long silky hairs.

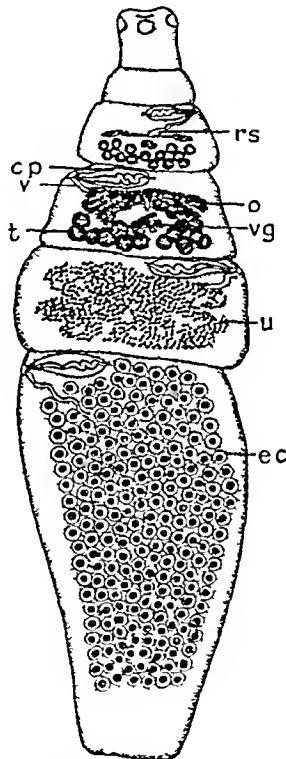


Fig 254 — *Davainea proglottina* Entire worm, $\times 53$
(Original)

Female Genitalia The ovary is a bilobed organ situated near the middle of the segment, anteriorly to the testes. The vagina lies posteriorly to the cirrus sac, its lumen is covered with fine hairs, about the middle of the segment it dilates into a receptaculum seminis. The uterus at first consists of a central cavity with lobes extending into the parenchyma, the walls eventually disappear, and the eggs thus come to lie free in capsules each containing a single egg. Sweet states that she has occasionally found from 2 to 13 eggs in each

capsule Fuhrmann considers that this condition merely indicates that the segment was not fully developed

The larval stages occur in slugs such as *Agriolimax agrestis*, *L. cinereus*, and *L. variegatus* Distribution cosmopolitan.

Jones (1929) reports obtaining larvæ of *D. proglottina* in the following snails — *Zonitoides arborea*, *Vallonia indentata*, *Gasterodonta ligera*, and *Polgyra thyroides*

Genus II. RAILLIETINA Fuhrmann, 1920

Synonym — *Bothriotænia* Railliet, 1892

Proglottides many, usually considerably more than 15 Suckers of medium size, armed or unarmed Genital pores unilateral or irregularly alternate Scolex rounded, simple. Rostellum with a double (rarely single ?) row of hooks Each uterine capsule with one or several eggs Adults in mammals and birds Larval stages in insects and reptiles

Type-species — *Raillietina tetragona* (Molin, 1858)

Key to Subgenera

- | | |
|---|--------------------|
| 1 Genital pore unilateral | 2 |
| Genital pores irregularly alternate | 3 |
| 2 Egg-capsules each containing several eggs | RAILLIETINA, p 74 |
| Egg-capsules each containing one egg | PARONIFLLA, p 90 |
| 3 Egg-capsules each containing several eggs | FUHRMANNETTA, p 99 |
| Egg-capsules each containing one egg | SKRJABINIA, p 97 |

Subgenus (α) *RAILLIETINA* Stiles & Orleman, 1926
(= *Ransomia* Fuhrmann, 1920)

The genital pores are unilateral and the egg-capsules each contain several oncospheres Type-species — *Raillietina* (*Raillietina*) *tetragona* (Molin, 1858)

It is not possible to give a satisfactory key to the Indian species of this subgenus

(1) *Raillietina* (*Raillietina*) *tetragona* (Molin, 1858) (Fig 255)

Synonyms — *Tænia tetragona* Molin, 1858

Davainea tetragona (Molin, 1858) R. Blanchard, 1891

Tænia bothriophiles Filippi, 1892

Monocleiscus davaineæ-tetragonæ Railliet, 1898

From (1) Domestic fowl, Berhampur, Bengal Southwell Burma Meggitt (2) *Pavo muticus*, *P. cristatus* (3) *Francolinus vulgaris*, Zoological Gardens, Calcutta Southwell

The worm attains a maximum length of 25 cm and a breadth of from 1 to 4 mm The genital pores are unilateral and are situated near the centre of the lateral margin of the segment The scolex is large, the rostellum is armed with about 100

hooks really arranged in a double row, but appearing to lie in a single row, each has a length of from 6 to 9 μ . The suckers are armed with from 8 to 10 rows of hooks.

There are from 20 to 30 testes, the cirrus sac does not reach the ventral excretory vessels. Each segment contains from 50 to 100 egg-capsules which extend externally to the excretory vessels. There are from 6 to 12 eggs in each capsule, each egg having a diameter of from 25 to 50 μ . The larval form occurs in *Musca domestica*.

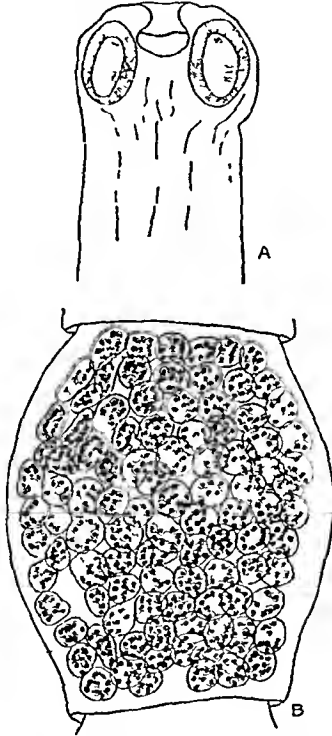


Fig 255 — *Raillietina (R) tetragona* A, head, $\times 56$, B, gravid segment, $\times 26$ (Original)

(2) *Raillietina (Raillietina) leptosoma* (Diesing, 1850)

Synonym — *Taenia leptosoma* Diesing, 1850

From *Platycercus eximius*, Burma. Meggitt

The worm attains a length of 16 mm and a breadth of 2 mm. The genital pores are unilateral. The head is armed with a double row of about 70 hooks. Accessory hooks absent. The suckers are armed.

Mature segments contain 60 testes which do not extend outwards beyond the nerve. The cirrus sac extends a little internally to the excretory vessels. Each egg-capsule contains about 20 eggs.

(3) *Railletina* (*Railletina*) *friedbergerei* (Linstow, 1878) Fuhrmann, 1920 (Fig 256)

Synonyms — *Tenia friedbergerei* Linstow, 1878

Tenia agama Megnin, 1878

Tenia infundibuliformis var *phasianorum* Neumann, 1878

From the black-shouldered peacock (*Pavo nigripennis*);
Berhampur, Bengal Southwell

The worm measures up to 20 cm in length and has a maximum breadth of about 3 mm. All the segments are broader than long. The genital pores are unilateral and are situated a

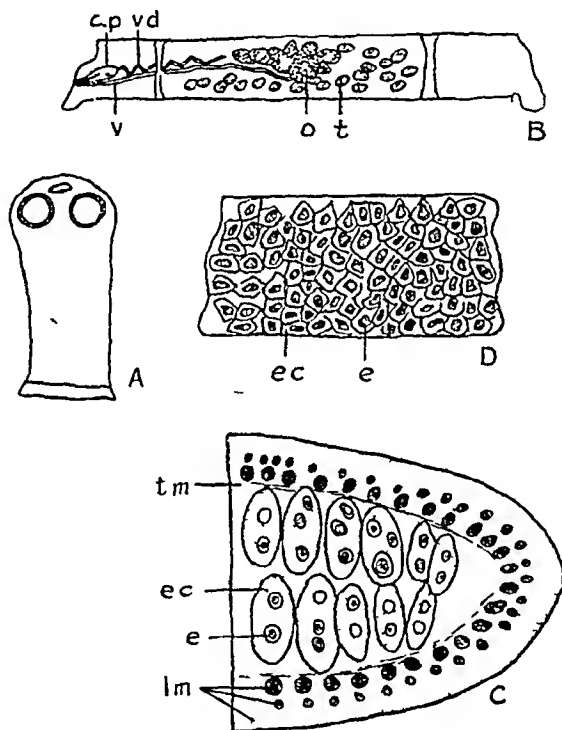


Fig 256 — *Railletina* (*R*) *friedbergerei*. A, head, B, mature segment, C, transverse section of gravid segment, D, gravid segment. Magnification unknown (After Baczyńska)

little posteriorly to the middle of the lateral margin of the segments. The head is somewhat pyriform and measures about $300\ \mu$ in length by $400\ \mu$ in breadth. The rostellum is armed with about 150 hooks arranged in a double crown, each hook having a length of about $12\ \mu$. The suckers are armed with 4 or 5 rows of small hooks which decrease in size towards the middle of the suckers.

The longitudinal muscles are arranged in a double layer of bundles. There are from 25 to 32 testes, on the pore side all the testes, about 7 or 8 in number, lie posteriorly to the ovary and vagina, the remaining testes being situated posteriorly and laterally to the ovary. The cirrus sac is very small, extending less than half the distance to the excretory canal. The cirrus is armed.

The ovary is a conspicuous lobed organ situated in front of the testes. The vagina lies posteriorly to the cirrus sac and dilates into a small receptaculum seminis near the middle of the segment. Each segment contains about 100 egg-capsules which have a diameter of about $156\ \mu$ and extend laterally to the excretory vessels, each contains 2 or 3 eggs.

(4) *Raillietina* (*Raillietina*) *celebensis* (Janicki, 1902)

Synonym — *Davainea celebensis* Janicki, 1902

From *Nesocia bengalensis*, Rangoon, Burma. Meggitt

The worm attains a length of 30 cm and a breadth of 1.1 mm. The genital pores are unilateral and are situated near the anterior extremity of the lateral margin of the segment. The rostellum has a diameter of from 130 to $180\ \mu$ and is armed with from 100 to 130 hooks, each of which measures from 20 to $26\ \mu$ in length, arranged in a double row. Immediately behind the rostellum there is a collar armed with spines, the suckers are unarmed. There are from 26 to 38 testes, of which 9 to 15 are poral and 17 to 23 aporal. The cirrus sac measures from 113 to $146\ \mu$ by 54 to $65\ \mu$ in mature segments, and extends to the nerve. There are from 180 to 200 egg-capsules in each segment, a few extending laterally to the excretory vessels, each capsule contains from 3 to 4 eggs.

(5) *Raillietina* (*Raillietina*) *microscolecina* (Fuhrmann, 1909)

Synonym — *Davainea microscolecina* Fuhrmann, 1909

From (1) A parrot (*Eclectus rosatus* = *Lorius loratus*) Zoological Gardens, Calcutta. Southwell. (2) *Cacatua moluccensis*, Victoria Memorial Park, Rangoon. Meggitt

The worm attains a length of from 7 to 10 cm, a maximum breadth of 1 mm, and is composed of very numerous segments. The genital pores are unilateral and are situated slightly in front of the middle of the lateral margin of the segment.

The scolex has a diameter of about $180\ \mu$, the rostellum has a length of $600\ \mu$ and is armed with from 160 to 200 hooks which according to Fuhrmann measure 9 or $10\ \mu$ in length, according to Meggitt 13 or $14\ \mu$. The suckers are armed anteriorly with 7 rows of hooks which may be entirely absent from the posterior margin. In the parenchyma there are numerous calcareous corpuscles measuring $10\ \mu$.

Male Genitalia There are from 16 to 20 testes The cirrus sac, according to Fuhrmann, has a length of 48μ , whilst according to Meggitt it attains a maximum length of 150μ Each gravid segment contains about 45 egg-capsules, each of which at first contains a single egg, but which, later on, may contain from 1 to 7

Meggitt writes that the "appearance suggests that the eggs are at first shed from the uterus into the parenchyma, become enclosed separately by modified parenchyma, and that the final capsules are formed by the coalescence of the primary capsules"

(6) *Raillietina* (*Raillietina*) *aruensis* (Fuhrmann, 1911)

Synonym — *Davainea aruensis* Fuhrmann, 1911

From *Lorvus lory*, Victoria Memorial Park, Rangoon
Meggitt

The worm attains a length of 26 cm and a maximum breadth of 2 mm It is composed of numerous segments, and the genital pores are unilateral The scolex measures 300μ in length and the suckers are unarmed The rostellum measures 100μ in length and is armed with 180 to 230 hooks, each measuring 17 or 18μ in length and arranged in a double row

Male Genitalia Fuhrmann states that there are 20 testes, 14 being aporal and 6 poral, Meggitt, however, says that there are from 10 to 17 testes The cirrus sac is oval and measures 130μ in length, it contains a vesicula seminalis and extends almost to the excretory vessels, the cirrus is armed The vas deferens lies coiled near the middle of the segment and is surrounded with prostatic cells

Female Genitalia The ovary is fan-shaped and has a breadth of about 400μ The mouth of the vagina is surrounded with a sphincter muscle The vitelline gland is compact and median, behind the ovary, and has a breadth of 100μ The eggs are in capsules, the latter not extending laterally to the excretory vessels Each contains numerous eggs Meggitt states that his specimens, obtained from an unusual host, were abnormal in all respects, many of the segments were wholly or partly sterile, male organs were present without female, or *vice versa*, and, in fact, various types of abnormalities were present

(7) *Raillietina* (*Raillietina*) *cohni* Baczynska, 1914. (Fig 257)

Synonym — *Davainea cohnii* Baczynska, 1914

From *Pterocles exustus* and *P. arenarius*, Zoological Gardens, Calcutta Southwell

The worm attains a length of from 2 to 3 cm and a breadth

of 1.7 mm. All the segments are broader than long, the genital pores are unilateral and are situated a little in front of the middle of the lateral margin of the segment. The scolex has a length of $192\ \mu$ and a breadth of $240\ \mu$. The rostellum has a length of $33\ \mu$ and bears about 160 hooks arranged in a double row, each having a length of $8\ \mu$. Each sucker is armed with 14 rows of hooks. The neck has a length of 1.62 mm and a breadth of $160\ \mu$. There are from 10 to 15 testes, disposed for the most part aporally. A single row of testes lies posteriorly to the female genital organs, as in *D. penetrans* Baczyńska, 1914. The vas deferens forms a few loops within the cirrus sac, outside the sac it follows an undulating course to the middle of the segment. The cirrus sac is very small and pyriform, measuring about $78\ \mu$ in length and $28\ \mu$ in breadth.

The ovary is much lobed and ramified and has a breadth of $640\ \mu$, it is situated in the anterior part of the segment,

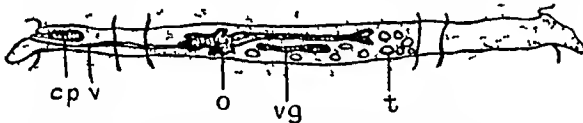


Fig 257 —*Raillietina (R.) cohnii*. Mature segment, magnification unknown (From Meggitt, after Baczyńska.)

immediately behind it is the vitelline gland, this is also lobed, and has a breadth of $104\ \mu$. The vagina opens posteriorly to the cirrus sac, and its terminal part is muscular, near the middle of the segment it dilates into a receptaculum seminis. The vagina measures about $100\ \mu$ in length and $18\ \mu$ in breadth. The eggs are grouped in capsules, each of the latter has a diameter of $130\ \mu$, and apparently contains 2 or 3 eggs, they extend laterally to the excretory vessels.

(8) *Raillietina (Raillietina) spiralis* (Baczyńska, 1914) (Fig 258)

From (1) Pigeons (*Columba* sp.), Zoological Gardens, Calcutta. Southwell. (2) *Crocopus phænicopterus*, Zoological Gardens, Calcutta. Southwell.

The worm measures 3 to 4 cm in length and has a breadth of about 1.28 mm. All the segments are much broader than long. The genital pores are unilateral and are situated at the extreme anterior corner of the lateral margin of the segment. The genital ducts pass between the excretory vessels. The head is relatively large and has a diameter of about $224\ \mu$. The four suckers are very small and are armed anteriorly with

7 rows of very fine hooks. The rostellum is large and has a diameter of $150\ \mu$, it is armed with about 300 hooks, each having a length of about $16\ \mu$. The longitudinal muscles are disposed in 3 rows of bundles, the most internal layer being the largest. In addition, there are isolated longitudinal muscles in the cortical parenchyma.

As in *Davainea paucitesticulata* Fuhrmann, 1909, the testes are few in number. The vas deferens has an undulating course and is surrounded laterally by numerous prostatic cells. The cirrus sac is muscular and has a length of about $100\ \mu$, the cirrus is also very muscular and is armed with long silky hairs. Where the vas deferens enters the cirrus sac there is a strong sphincter.

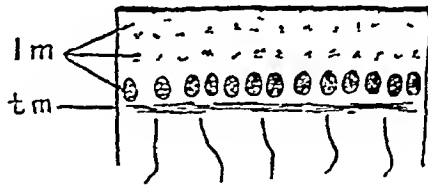


Fig 258 —*Raillietina (R) spiralis*. Transverse section, showing musculature, magnification unknown (After Baczynska.)

muscle. The ovary is flat and has a breadth of $352\ \mu$. The vitelline gland is relatively large, situated behind the ovary, and measures about $83\ \mu$. The vagina opens posteriorly and ventrally to the cirrus sac. Near the pore it is very muscular and is furnished with a strong sphincter muscle, as is the cirrus sac. The vagina runs in the median direction, almost in a straight line, and dilates into a small fusiform receptaculum seminis which has a length of about $52\ \mu$. The eggs are in capsules which are not numerous, each has a diameter of about $104\ \mu$ and contains from 4 to 6 eggs, they do not extend laterally to the excretory vessel.

(9) *Raillietina (Raillietina) polychalix*, Kotlán, 1920-21 (Fig 259)

Synonym —*Davainea polychalix* Kotlán, 1920-21

From *Lorius garrulus*; Zoological Gardens, Calcutta Southwell

The worm attains a length of 5.5 cm and a maximum breadth of 1.7 mm. The segments are all broader than long and very shallow. The genital pores are unilateral and are situated at the extreme anterior corner of the lateral margin of the segment. The scolex has a breadth of $320\ \mu$, the rostellum is armed with from 240 to 250 hooks, each having a length of about $13\ \mu$ and arranged in a double row. The suckers are armed with 4 or 5 rows of minute hooks.

The longitudinal muscles are arranged in a double layer of bundles. There are about 10 testes, 4 being poral and lateral to the ovary and 6 being aporal and also lateral to the ovary. The cirrus sac is small, extending only half the distance from the margin to the nerve, within the sac there is a conspicuous

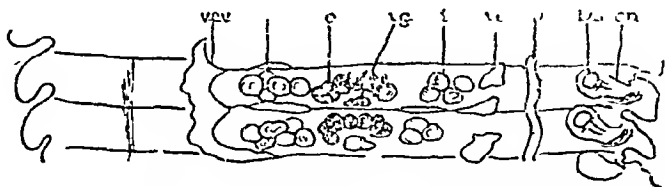


Fig 259 —*Raillietina (R.) polyhalis* Mature segment, $\times 113$
(After Kotlan)

seminal vesicle. The vas deferens follows a sinuous course, but is not coiled. The ovary is situated in the middle of the segment and is not bilobed, immediately posterior to it is a small vitelline gland. Each segment contains from 24 to 26 egg-capsules, which extend laterally to the excretory vessels and contain each from 2 to 5 eggs.

(10) *Raillietina (Raillietina) fuhrmanni* (Southwell, 1922)
(Figs 260, 261, & 262)

Synonym —*Davainea fuhrmanni* Southwell, 1922

From (1) *Crocopus phœnicopterus*, Calcutta. Southwell. Victoria Memorial Park, Rangoon, Meggitt. (2) *Crocopus phayrei*, Calcutta. Southwell.

The worm attains a maximum length of about 8 cm and a breadth of $700\ \mu$, it exhibits very considerable variations, in young segments the genital pores, which are unilateral, are situated at the extreme anterior margin, whilst in mature and gravid ones each is slightly in front of the middle. The segments vary in shape, in some worms they are all broader than long except the last few, which are square, in other specimens they are somewhat bell-shaped, whilst in still others the terminal proglottides are twice as long as broad. The longest posterior segment measures 1.2 mm in length and $700\ \mu$ in breadth. The head has a length of $330\ \mu$ and a breadth of $250\ \mu$. The large rostellum, which is about $100\ \mu$ in length and $150\ \mu$ in breadth, is armed with a double row of about 110 hammer-shaped hooks, each measuring from 25 to $30\ \mu$, the hooks in the anterior row being slightly larger than those in the posterior row. There is no rostellar collar. The suckers have a diameter of about $70\ \mu$ and are armed with several rows of minute hooks, according to Meggitt, however,

they bear only 2 to 3 rows. The neck varies in length from $300\ \mu$ to $1.4\ \text{mm}$. There is a single nerve situated laterally to the ventral water-vessel and ventrally to the cirrus sac. A single (ventral) excretory vessel runs along each lateral margin, that on the pore side lies ventrally to the cirrus sac, and is situated further from the lateral margin than is the aporal vessel. This asymmetry is not, however, always pronounced.

Muscular System. The longitudinal muscles are well developed, the bundles are arranged in a single layer, the external being smaller in every way than the internal bundles, the arrangement is best seen in young adults. The circular

Fig 260

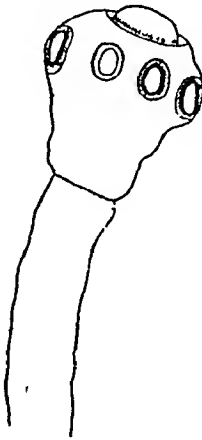


Fig 261



Raillietina (R.) fuhrmanni

Fig 260 —Head and neck, $\times 170$ (After Southwell)

Fig 261 —Rostellar hook, $\times 1125$ (After Southwell)

fibres consist of a very narrow layer lying immediately internally to the longitudinal fibres. Oblique fibres are very scanty.

Male Genitalia. The testes lie dorsally, and are about twelve in number, seven or eight on the aporal side of the ovary, one or two posteriorly and laterally to the yolk gland, and the rest—usually three—on the poral side of the ovary; they do not extend beyond the water-vessels. The vas deferens is a long, loosely-coiled, slightly dilated tube, extending quite halfway across the segment, and surrounded throughout its length by a dense mass of glandular tissue—the prostate gland, it reaches its full development somewhat late, seminal vesicle apparently absent, probably the elongated vas deferens functions as such. The cirrus sac is large and measures, in mature segments, about $170\ \mu$ in length and $80\ \mu$ in breadth.

According to Meggitt, it has a length of 87 to 98 μ only. It lies across the antero-lateral angle of the segment and extends just median to the lateral excretory vessel. The cirrus is armed with large spines measuring about 17 μ , these, however, cannot always be seen.

Female Genitalia. The ovary is sometimes bilobed, each lobe having a rounded appearance. According to Meggitt, it consists when young of three or four large, entire, spherical lobes, but when it is mature it becomes sac-like. It is placed slightly behind the centre of the segment. The vagina is a long, muscular, sinuous tube, the terminal portion which lies posteriorly to the whole length of the cirrus sac is often, but not always, dilated. Its extreme lateral extremity opens at the base of a well pronounced sinus, situated immediately

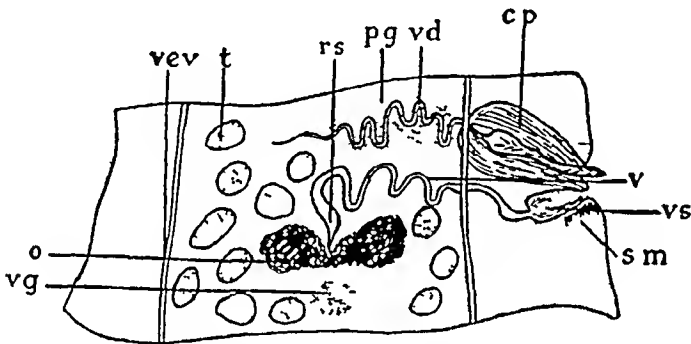


Fig. 262 —*Raulietina (R.) juhrmanni*. Mature segment, $\times 140$.
(After Southwell.)

behind the cirrus sac, a well developed sphincter muscle surrounds the opening of the vaginal sinus. Slightly in front of the ovary the vagina dilates into a small but somewhat elongated receptaculum seminis. The vitelline gland lies posteriorly to the ovary, and is easily seen, in size it is almost equal to one wing of the ovary. The uterus is first visible as a small irregular cavity, situated immediately anterior to the vitelline gland, it enlarges rapidly, eventually filling the entire segment between the water-vessels. The eggs when first seen appear as a dense granular mass filling the uterus. A few segments further back 40 capsules are differentiated, each containing six or seven, and rarely nine to eleven, oncospheres. At first the mature uterus lies strictly within the excretory vessels, but in the last five or six segments these have disappeared, and the entire segment is occupied by the capsules. Black pigment occurs abundantly in the posterior two-thirds of the worm. The egg measures about 36 μ .

(11) *Raillietina* (*Raillietina*) *parvuncinata* Meggitt, 1924

From ducks, Rangoon Meggitt

The worm attains a length of from 11 to 12 cm and a breadth of $200\ \mu$. All the proglottides are broader than long except a few of the posterior ones, which are longer than broad. The genital pores are unilateral and are situated slightly anterior to the centre of the lateral margin of the segment. The scolex measures from 260 to $370\ \mu$ in diameter. The rostellum has a diameter of from "0.026 to 0.3 mm" (*sic*), and extends posteriorly past the anterior margin of the suckers, it is armed with about 150 T-shaped hooks arranged in two rows, each having a length of from 7 to $9\ \mu$. The suckers are armed with 9 rows of hooks which decrease in size towards the centre of the suckers.

Muscular System The muscles are weakly developed and consist of an inner transverse and an outer longitudinal layer, the latter comprises a number of widely scattered small bundles extending to the subcuticula.

Male Genitalia The testes vary in number from 24 to 39, the average number being about 27, of these, 9 to 12 are poral and 18 to 20 aporal. A few testes may extend laterally to the excretory vessel. The vas deferens is only slightly coiled. The genital ducts pass between the longitudinal excretory vessels. The cirrus sac varies in length from 580 to $840\ \mu$, extending median to the nerve.

Female Genitalia The ovary, which is slightly poral, consists of a small central mass from which radiate numerous tubular outgrowths. The vitelline gland is compact and is situated behind and slightly lateral to the middle of the ovary. Between the excretory vessel and the ovary the vagina dilates into a long conspicuous receptaculum seminis. Each segment contains up to 50 egg-capsules, which extend laterally to the excretory vessels. The mature capsule contains from 11 to 13 eggs.

(12) *Raillietina* (*Raillietina*) *torquata* (Meggitt, 1924) (Fig 263)

Synonym — *Houttuynia torquata* Meggitt, 1924

From pigeons (*Columba* sp.), Rangoon Meggitt

The worm attains a length of 23 cm and a maximum breadth of 2.5 mm. The scolex has a diameter of about $90\ \mu$. The rostellum is armed with about 150 hooks measuring 7 and $7.5\ \mu$, the two sizes alternating. Surrounding the posterior part of the rostellum is a barrel-shaped collar thickly studded with deciduous hooks each $8\ \mu$ in length. The posterior segments are slightly longer than broad. The genital pores are unilateral and are situated near the centre of the margin of the proglottis, the genital atrium is small.

Muscular System This is weak, and consists of a double layer of transverse fibres, external to which there are, both dorsally and ventrally, from 13 to 18 longitudinal muscle bundles. Externally to the latter a second layer of scattered longitudinal

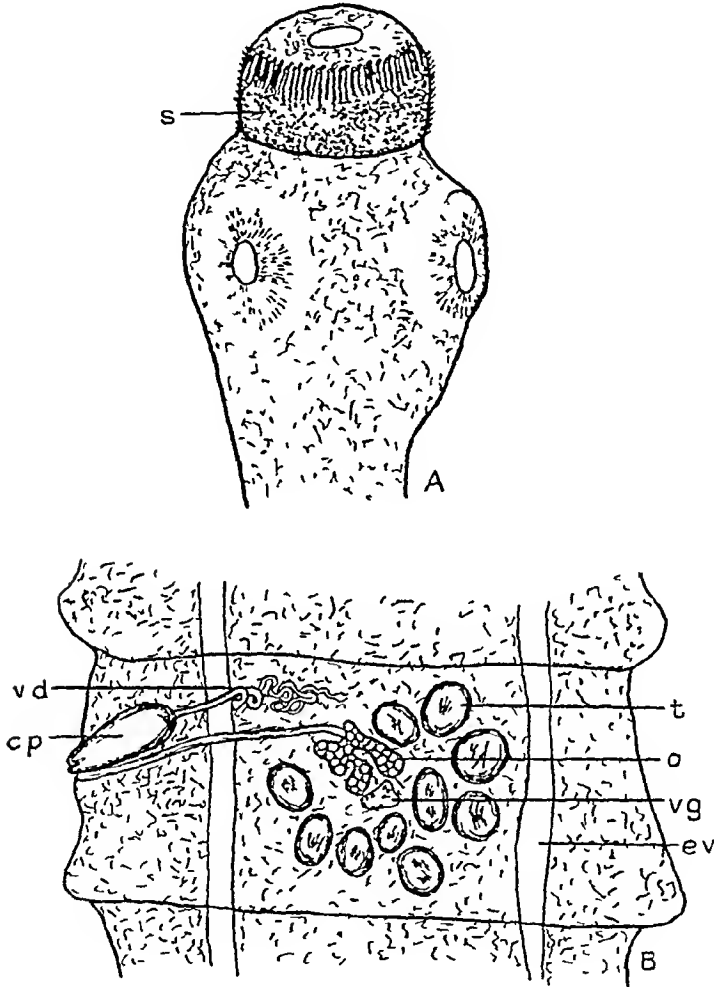


FIG 263 — *Raillietina (R.) toquata* A, head, $\times 427$, B, mature segment, $\times 133$ (After Meggitt)

fibres extends to the subcuticula. A few dorso-ventral muscles are also present.

Excretory System This consists of four longitudinal vessels. In immature segments a fifth vessel may be present.

Male Genitalia There are from 8 to 10 testes, two poral, one or two posteriorly to the ovary, and the remainder aporal.

The cirrus sac is small, extending only to the nerve, it contains a small vesicula seminalis. The cirrus is armed, internally to the longitudinal excretory vessel the vas deferens is thrown into a number of coils.

Female Genitalia The ovary consists of two subdivided lobes, and is situated near the centre of the segment. The vagina is a simple tube, and a receptaculum seminis is absent. The vitelline gland lies immediately behind the ovary. The primary uterus disintegrates, and the eggs become embedded in parenchymatous capsules each containing from 3 to 5, there are from 30 to 40 capsules in each proglottis, and they extend laterally to the excretory vessels.

(13) *Raillietina* (*Raillietina*) *nagpurensis* Moghe, 1925 (Fig 264)

From the domestic pigeon, Nagpur, Central Provinces, India Moghe

The worm attains a length of from 25 to 27 cm and a breadth of about 1.9 mm, it is composed of from 465 to 530 segments, all of which are broader than long. The genital pores are unilateral and are situated near the middle of the lateral margin of the segment, but they vary slightly and may be a little more anterior. There is a well developed genital atrium. The

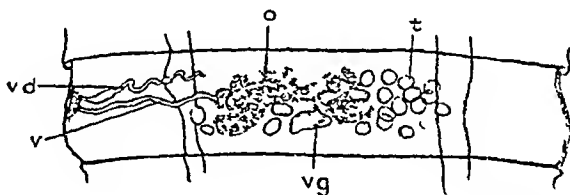


Fig 264 -- *Raillietina* (*R.*) *nagpurensis* Mature segment, $\times 32$
(After Moghe)

scolex is almost globular and measures about 340 to 380 μ in breadth. The rostellum is armed with about 220 hooks arranged in a double row, the large hooks measure 19 μ and the small ones 17 μ . The suckers are armed with a single marginal row of hooks, each of which measures about 7 μ . There is no neck.

Male Genitalia There are from 19 to 22 testes which lie laterally and posteriorly to the ovary, most of them are situated aporally, only two or three being poral and two between the ovary and the vitelline gland. The vas deferens is very short and coiled. The cirrus sac measures about 90 by 30 μ , and does not extend to the longitudinal excretory vessel.

Female Genitalia The ovary is a large, irregularly lobed organ having a maximum breadth of about 645 μ and placed

slightly on the pore side, the vagina opens posteriorly to the cirrus sac. There is a large receptaculum seminis. The vitelline gland is placed centrally, just posteriorly to the ovary, and is of a somewhat irregular shape. The shell gland lies between the vitelline gland and the ovary, there are from 50 to 94 egg-capsules in each segment which do not extend laterally to the excretory vessels. Each capsule contains from 3 to 8 eggs (usually 5 or 6), which latter measure about 50 by 43 μ and the oncosphere 17 by 14 μ .

(14) *Raillietina* (*Raillietina*) *quadritesticulata* Moghe, 1925
(Fig 265)

From the red turtle-dove (*Aenopopelia tranquebarica*), Nagpur, Central Provinces, India. Moghe

The worm attains a length of from 6 to 14 cm and a breadth of 1.23 mm. It is composed of from 188 to 196 segments, all of which are broader than long, the genital apertures are unilateral and situated in the middle of the lateral margin of the segment, there is a well developed genital atrium. The scolex is bluntly rounded and has a breadth of about 165 μ . The rostellum is armed with about 180 hooks, arranged in a double row, the hooks in each row being of the same size, viz, 6 μ . The suckers are armed with about 5 rows of hooks. The neck measures approximately 1 mm in length.

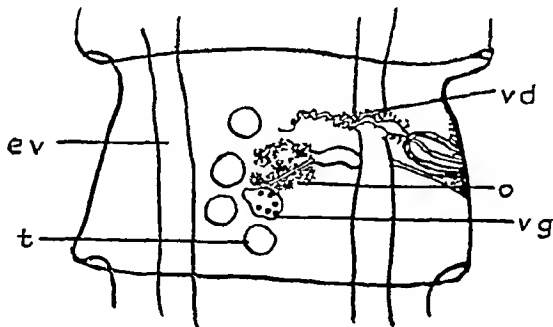


Fig 265 — *Raillietina* (*R*) *quadritesticulata* Mature segment, $\times 47$
(After Moghe)

There are only 4 testes, 3 are situated laterally to the aporal ovary and one posteriorly to the vitelline gland. The vas deferens is a loosely coiled tube. The cirrus sac is muscular, it measures about 138 μ by 68 μ , and does not extend to the longitudinal excretory vessels. The ovary is lobulated and centrally placed. The vitelline gland is posterior to the ovary and slightly aporal. The shell gland is lateral to the ovary and anterior to the vitelline gland. The vagina opens posteriorly to the cirrus sac and ventrally to the excretory vessel. Near

the ovary it dilates into a large receptaculum seminis. There are from 40 to 50 egg-capsules in each segment, and they do not extend beyond the longitudinal excretory vessels. Each contains from 6 to 8 eggs, which latter measure 67 by 54μ and the oncosphere 18 by 16μ .

(15) *Railletina* (*Railletina*) *flaccida* Meggitt, 1926 (Fig 266)

From the imperial sand-grouse (*Pterocles orientalis*) Victoria Memorial Park, Rangoon Meggitt

The worm measures from 13 to 15 cm in length and has a maximum breadth of 1.2 mm. The genital pores are unilateral and are situated slightly anterior to the middle of the lateral margin of the segment. The rostellum is armed with

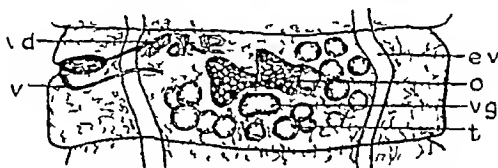


Fig 266 — *Railletina* (*R*) *flaccida* Mature segment, $\times 53$
(After Meggitt, in 'Parasitology')

about 150 hooks arranged in two rows, those in one row measure 17μ and those in the other 22μ . The suckers are unarmed.

Male Genitalia There are from 14 to 17 testes, 5 of which are parafallic, the remainder being situated behind the ovary and aporally. The cirrus sac is small, attaining a maximum length of 100μ and extending to the nerve.

Female Genitalia The ovary is bilobed, both parts being entire. Each segment contains about 50 egg-capsules which extend laterally to the excretory vessels, and each contains 8 or 9 eggs.

(16) *Railletina* (*Railletina*) *famosa* Meggitt, 1927 (Fig 267)

From the bird *Eclectus pectoralis* (= *Lorius pectoralis*), Victoria Memorial Park, Rangoon Meggitt

The worm attains a length of 25 cm and a maximum breadth of 1.2 mm. The genital pores are unilateral and are situated near the centre of the margin of the segment, a genital atrium being present or absent according to the state of contraction of the segment. The sealex has a diameter of 150μ and the suckers are unarmed. The rostellum has a diameter of 80μ and is armed with about 180 hooks, each measuring from 10 to 12μ .

Male Genitalia There are from 25 to 29 testes, 6 to 11 of these being parafallic and 14 to 18 apofallic. The cirrus sac extends

to the longitudinal nerve, and has a length of from 110 to 130 μ

Female Genitalia These present no special features except that, close to the genital pore, the vagina is very muscular

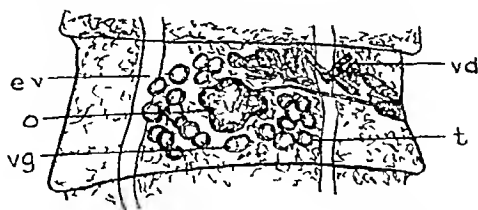


Fig 267 *Raillietina (R.) lamosa* Mature segment, $\times 53$
(After Meggitt, in 'Parasitology')

There are from 20 to 38 egg-capsules in each segment, and they extend laterally to the excretory vessels, each contains 2 or 3, and occasionally from 4 to 6 eggs

(17) *Raillietina (Raillietina) flabialis* Meggitt, 1927 (Fig 268)

From the great hornbill, *Dichoceros bicornis*, Victoria Memorial Park Rangoon Meggitt

The worm attains a length of 35 cm and a maximum breadth of 1 mm. The terminal segments are square, the genital pores are unilateral and are situated at the centre of the margin of the proglottides, genital atrium practically absent. The scolex measures about 216 μ in diameter. The rostellum, which has a diameter of 80 μ , is armed with 350 hooks, each

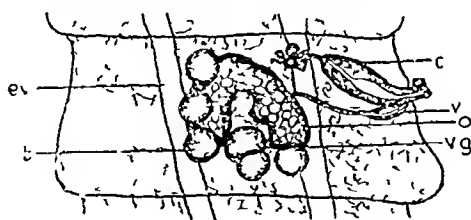


Fig 268 — *Raillietina (R.) flabialis* Mature segment, $\times 50$
(After Meggitt, in 'Parasitology')

having a length of 6 μ and arranged in two rows. Behind the rostellum there is a spiny collar.

Male Genitalia There are 4 or 5 testes usually 3 along the posterior margin of the segment and 2 aporally, there being none on the pore side. The cirrus sac attains a maximum length of 120 μ , barely reaching to the excretory vessels, and contains a few coils of the vas deferens and a wide duct which serves as a vesicula seminalis, the end of the cirrus sac is

protrusible and the duct capable of evagination, there being no trace, other than this duct, of a cirrus, no spines are found in the cirrus sac

Female Genitalia The ovary is horse-shoe-shaped, the concavity being directed posteriorly, it entirely fills the ventral surface between the excretory vessels, except for the space occupied by the vitelline gland. There are from 17 to 23 egg-capsules in two layers in each segment, they do not extend laterally to the excretory vessels, each has a diameter of from 130 to 140 μ and contains 10 eggs

This species resembles *Raillietina* (R) *quadrtesticulata* Moghe, 1925, so closely that the two species are indistinguishable except that in *Raillietina* (R) *flabralis* there is a spiny collar behind the rostellum. Whether such a structure is present in *Raillietina* (R) *quadrtesticulata* is not stated, but Meggitt remarks that it is often impossible to see it except in living worms

(18) *Raillietina* (*Raillietina*) *celebensis* var *paucicapsulata*
Meggitt, 1927

From (1) *Rattus norvegicus* and (2) *Nesocia bengalensis*,
Rangoon Meggitt

The worm attains a length of 24.2 cm and a breadth of about 1 mm. The genital pores are unilateral and are situated a little in front of the centre of the lateral margin of the segment. The rostellum has a diameter of from 140 to 170 μ , it is armed with from 100 to 120 hooks, each measuring from 20 to 25 μ in length and arranged in a double crown. Immediately behind the rostellum there is a spiny collar, the suckers are unarmed

There are from 33 to 35 testes, of which from 11 to 15 are polar and from 20 to 23 are apolar. The cirrus sac measures from 89 to 113 μ by 48 to 65 μ in mature segments and extends to the nerve. There are from 100 to 120 egg-capsules in each segment, a few of which extend laterally to the excretory vessels. Each capsule contains from 3 to 4 eggs. Meggitt states that the "present form agrees closely with *Raillietina* (*Raillietina*) *celebensis* except for the gravid proglottides. In that latter respect the two forms are clearly different." He does not state, however, in what way they are different

Subgenus (b) *PARONIELLA* Fuhrmann, 1920

Raillietina in which the genital pores are unilateral. Egg-capsules each contain a single oncosphere. Adults in birds and mammals

Type-species — *Raillietina* (*Paroniella*) *longispina* (Fuhrmann, 1909)

It is not possible to give a satisfactory key to the species of this subgenus, but the following table will serve to indicate some of the points of difference between them —

	Testes	No of hooks	Size of hooks
<i>urogalli</i>	130	160	15 μ
<i>cruciata</i>	"	200	15 μ
<i>corvina</i>	26	80	16 μ
<i>ceylonica</i>	"	120	10 μ
<i>triagopani</i>	6 or 7	46	10 μ
<i>facile</i>	9	85	11 μ
<i>contorta</i>	2		"

(1) *Raillietina* (*Paioniella*) *urogalli* (Modeer, 1790) Fuhlmann, 1920 (Fig 269)

Synonyms — *Ptena urogalli* Modeer 1790

Tænia calva Band 1853

Davinea calva (Band, 1853) Stiles, 1896

From a partridge pheasant (*Alectoris græcachukar*), Zoological Gardens, Calcutta Southwell

The worm may attain a length of 35 cm and a maximum breadth of 4 mm. The genital pores are unilateral and are situated in the anterior third of the lateral margin of the segment. The scolex has a diameter of from 250 to 270 μ . The rostellar bulb has a diameter of from 68 to 88 μ and is armed with a double crown of about 160 hooks, each having a length of from 14 to 16 μ . The suckers are armed, the neck varies in length from 200 μ to 3 or 4 mm.

Muscular System This is a well developed and almost fills the entire cortical parenchyma. It consists of groups of bundles irregularly disposed, some of which contain from 2 to 4 fibres and others from 8 to 12. In addition, numbers of single, slender fibres are seen in transverse section, but in gravid segments only solitary fibres are found. The transverse muscles are disposed peculiarly, unlike what occurs in many cestodes, they do not separate the cortical from the medullary parenchyma, but are distributed between the inner longitudinal fibres.

Excretory System Apparently there is only one longitudinal vessel on each side viz, the ventral vessel. It measures from 60 to 80 μ in diameter. The transverse vessel in each segment is wider than the longitudinal one.

Male Genitalia There are at least 130 testes in each segment, this being the only species of *Raillietina* possessing such a large number, they surround the female glands. On the poral side there are from 28 to 36, whilst aporally there are from 84 to 100. The vas deferens is much coiled, it runs parallel to the anterior margin of the segment to the level of the ovary and is surrounded with prostatic cells. The cirrus

sac is small and pyriform, measuring only from 110 to 120 μ . The cirrus is armed.

Female Genitalia The ovary is bilobed and lies slightly on the poral side, it measures from 440 to 500 μ in breadth, each half is further subdivided into a number of secondary lobes. The vagina opens posteriorly to the cirrus sac, its terminal part is muscular and its lumen bears a number of silky hairs. The muscular termination of the vagina extends internally to the nerve and passes between the excretory vessels, it continues in the median direction almost directly to the female genital organs. Its main part functions as a receptaculum seminis. The vitelline gland is situated behind the ovary, it

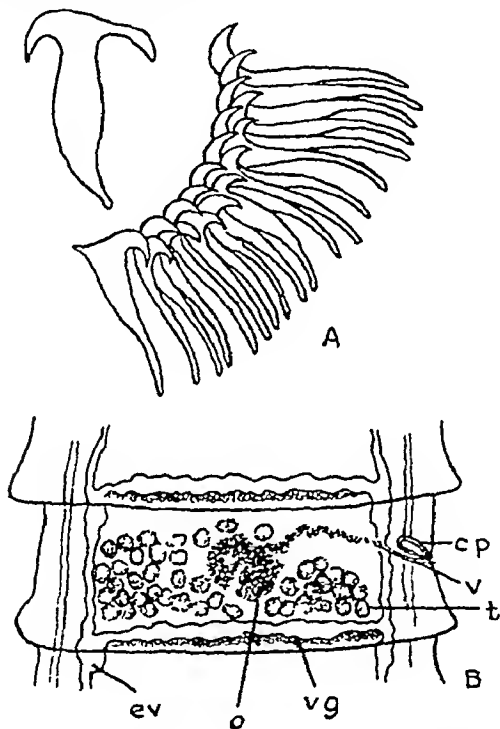


Fig 269 — *Raillietina* (*Paroniella*) *urogalli*. A, rostellar hooks, B, mature segment, magnification unknown (After Shipley)

is slightly lobed and has a breadth of about 130 μ . The shell gland is very small and is situated dorsally to the middle of the ovary. The uterus is dorsal and slightly anterior to the ovary, resembling the latter in shape, *i.e.*, it consists at first of a central cavity with radiating lobes. The latter extend into the medullary parenchyma, their walls eventually disappear and the eggs come to rest in the parenchyma. In gravid segments they lie singly in capsules which do not extend laterally to the excretory vessels. The oncosphere measures from 24 to 30 μ and the capsule has a diameter of about 68 μ .

(2) *Raillietina* (*Paromella*) *cruciata* (Rudolphi, 1819)

From a magpie (*Pica rustica*), Zoological Gardens, Calcutta Southwell

A single specimen with unilateral pores, believed to be referable to the above species, has been recorded. The rostellum is armed with about 200 hooks, each measuring about $15\ \mu$, and arranged in a double row. The suckers are armed with minute hooklets. Each egg-capsule contains a single egg.

(3) *Raillietina* (*Paromella*) *corvina* (Fuhmann, 1905) (Fig 270)

Synonym — *Davamea polycalcaria* Linstow, 1906

From (1) *Corvus macrorhynchus*, Colombo, Ceylon Southwell Calcutta, Sabour, Bihar, India Southwell (2) *Corvus splendens*, Calcutta Southwell (3) *Corvus* sp., Khulna, Bengal, and Chilka Lake, Orissa, India Southwell

The worm attains a length of 12 cm and a breadth of from 2 to 3 mm. The unilateral genital pores are situated near the

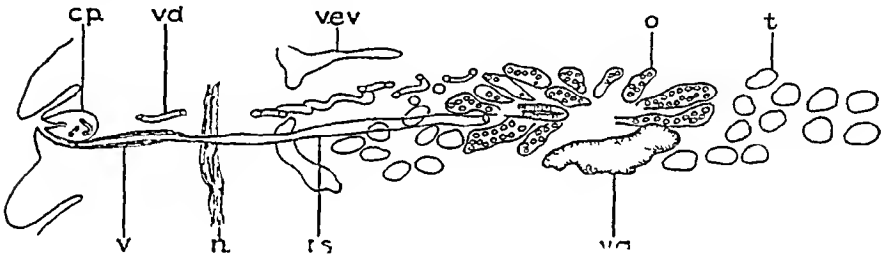


Fig 270 — *Raillietina* (*Paromella*) *corvina* Horizontal section of mature segment, magnification unknown (After Fuhmann)

middle of the lateral margin of the segment, all the latter are broader than long. The rostellum is armed with about 80 hooks, each measuring from 16 to $18\ \mu$ in length. The suckers are armed with from 5 to 6 rows of hooks, each hook measures about $9\ \mu$. The testes are numerous (about 26) and are situated in two groups, one on each side of the ovary. The vas deferens is much coiled, and runs parallel and anteriorly to the vagina. The cirrus sac is extremely small, measuring $100\ \mu$ in length by $40\ \mu$ in breadth, and only extending about one-third the distance between the margin of the segment and the nerve, the cirrus is unarmed. The ovary is situated in the middle line and consists of a number of tubule-like follicles, arranged fanwise. Immediately behind it is a small vitelline gland presenting a granular appearance, the vagina opens to the genital atrium posteriorly to the cirrus sac, its terminal part, viz, that lying between the pore and the nerve, is surrounded by cells. It continues in the median direction.

as a straight tube which, internally to the nerve, dilates a little and functions as a receptaculum seminis. The uterus breaks up into capsules, each of which contains a single egg.

(4) *Raillietina (Pavoniella) ceylonica* (Baczynska, 1914) (Fig 271)

From (1) *Crocopus phaeucopterus*, Zoological Gardens, Calcutta, and Chilka Lake, Orissa, India. Southwell. (2) The white-bellied pigeon (*Columba leuconata*), Zoological Gardens, Calcutta. Southwell. (3) *Pavo cristatus*, Ceylon. Fuhrmann.

The worm attains a length of from 3 to 4 cm. and a breadth of 1.3 mm. All the segments are broader than long, the gravid ones have a length of $730\ \mu$ and a breadth of $1.98\ \text{mm}$. The genital pores are unilateral and are situated in the anterior third of the lateral margin of the segment. The head has a diameter of $400\ \mu$, the rostellum is armed with about

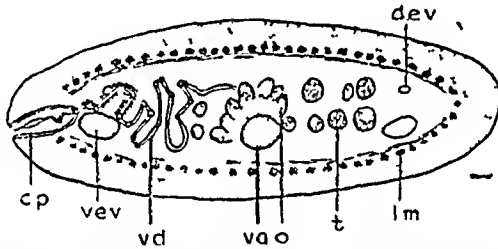


Fig 271 —*Raillietina (Pavoniella) ceylonica*. Transverse section of mature segment, magnification unknown. (After Baczynska.)

120 hooks arranged in a double row, each hook measuring about $10\ \mu$. The suckers are armed with minute spines.

The longitudinal muscles consist of a single layer of rather large and conspicuous bundles. Externally to them there are numerous small groups of fibres. The transverse and dorso-ventral musculatures are poorly developed. The ventral excretory vessel is very much larger than the dorsal one. The testes are few in number, and are disposed to the left and to the right of the female genital organs. Each testis has a diameter of about $50\ \mu$. The cirrus sac is pyriform and almost cylindrical, it barely reaches the excretory canal, and has a length of $130\ \mu$ and a breadth of $31\ \mu$. The cirrus is muscular. The vas deferens is very undulated, and is surrounded by a number of pigmented glandular cells. Within the cirrus sac it is thrown into slight undulations. The ovary is in the middle of the segment, it is deeply lobed and has a length of $192\ \mu$ and a breadth of $256\ \mu$. Immediately ventral to it is the vitelline gland, which has a length of $78\ \mu$ and a breadth

of $91\ \mu$. The shell gland, which has a diameter of $39\ \mu$, is situated dorsally to the vitelline gland. The vagina opens posteriorly and ventrally to the cirrus sac, and is a long canal thrown into undulations. The receptaculum seminis has a length of $86\ \mu$, the egg-capsules each contain from 6 to 10 eggs, each has a diameter of $192\ \mu$, and they extend laterally to the excretory vessels. The egg measures $28\ \mu$ and the oncosphere $18\ \mu$.

(5) *Raillietina* (*Paroniella*) *tragopan* (Southwell, 1922) (Fig 272)

From a tragopan pheasant (*Tragopan* sp.), Zoological Gardens, Calcutta Southwell

The worm measures 8.5 mm in length and its greatest breadth is $600\ \mu$. It is composed of 27 or 28 segments, the last one measuring $825\ \mu$ in length and $600\ \mu$ in breadth. The genital pores are unilateral and are situated a little anterior to

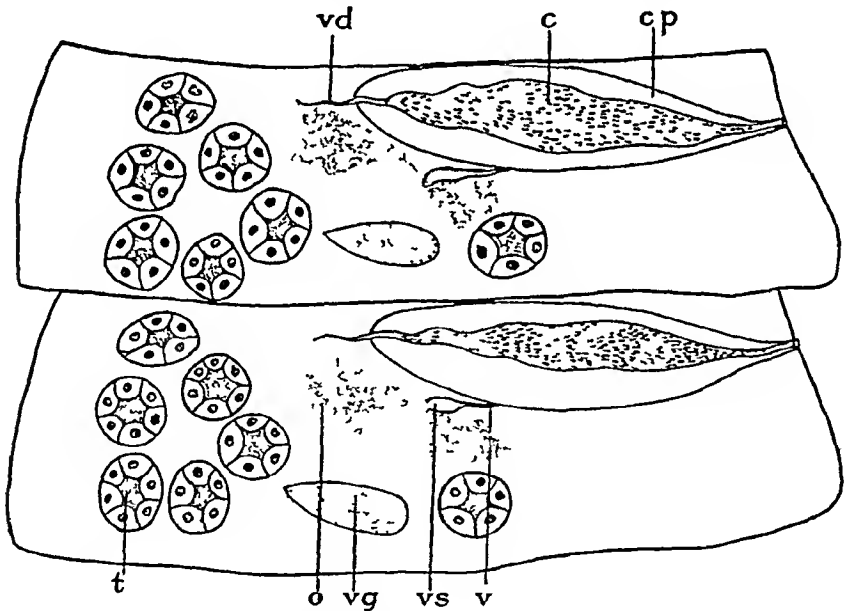


Fig 272 — *Raillietina* (*Paroniella*) *tragopan* Mature segments, $\times 210$ (After Southwell)

the middle of the lateral margin of the segment. The head has a length of $125\ \mu$ and a breadth of $180\ \mu$. The total number of hooks is about 46, and they are apparently in a single row, each measures about $10\ \mu$ in length. The suckers are armed with from 4 to 6 rows of hooks. The neck has a length of about $300\ \mu$.

There are 6 or 7 testes in each segment, and they first appear in about segment 4. When fully mature they measure about $70\ \mu$. Usually there are four situated aporally, one or two posteriorly to the ovary, and a single testis on the pore side, behind the internal extremity of the cirrus. The cirrus sac, when fully developed, extends at least halfway across the segment, and has very thick (? muscular) walls. In segment 17 it measures $250\ \mu$ in length and $110\ \mu$ in breadth, it persists to the last segment. The cirrus is peculiar in being a greatly dilated organ densely covered with minute spines, and almost filling the cirrus sac. The vas deferens is short and slightly coiled, seminal vesicle apparently absent.

The ovary, which first appears in about segment 8, is definitely bilobed, each half being globular, $70\ \mu$ in diameter, and composed of a number of rounded acini. From the pore the vagina pursues a direct course to the mid-ovarian region, where it dilates into a receptaculum seminis. The vitelline gland lies posteriorly to the ovary and is a conspicuous organ. In full development it has a diameter of about $60\ \mu$. The uterus first appears as a small cavity immediately anterior to and between the two lobes of the ovary. It enlarges and eventually single eggs become isolated in the parenchyma. In the last few segments no trace of the excretory vessels can be seen, it is therefore impossible to say definitely whether the eggs extend beyond them or not. But, as there is a clear area between the edge of the segment and the eggs, it would appear that the latter lie ventrally to the excretory vessels. The egg has a diameter of about $54\ \mu$ and the oncosphere of $25\ \mu$.

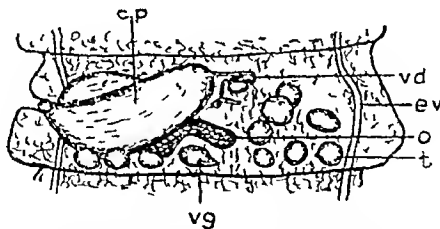


Fig 273 —*Raillietina (Paroniella) facile* Mature segment, $\times 107$
(After Meggitt, in 'Parasitology')

(6) *Raillietina (Paroniella) facilis* Meggitt, 1926 (Fig 273)

From the pheasant *Tragopan satyra*, Rangoon, Burma
Meggitt

The worm attains a length of 4 mm and a breadth of $700\ \mu$, and is composed of from 15 to 20 segments. The genital pores are unilateral and are situated in the centre of the margin of the proglottis at the bottom of a shallow genital atrium. The

rostellum is armed with a single row of 85 hooks, each having a length of from 10.3 to $12\ \mu$. The suckers are armed with deciduous hooks varying in length from 9 to $11\ \mu$, apparently arranged in from 3 to 4 rows.

Male Genitalia There are 9 testes in each segment (10 figured), three of these being paroral and the remainder aporal, they are lateral to the female glands. The cirrus sac is very large and is the most conspicuous structure in the segment. It measures about 180 by $80\ \mu$ and in young proglottides extends beyond the centre. The cirrus is armed.

Female Genitalia The ovary is slightly paroral, small and bilobed, each half being entire. The vagina is marked by a swelling almost as large as the cirrus sac, situated near the genital pore. The eggs lie singly in capsules which do not extend beyond the excretory vessels, but otherwise entirely fill the segment.²

Subgenus (c) *SKRJABINIA* Fuhrmann, 1920

Raillietina in which the genital pores are irregularly alternate and in which the egg-capsules each contain a single egg. Type-species — *Raillietina (Skrjabinia) cesticillus* (Mohn, 1858)

Key to Species

Suckers armed
Suckers unarmed

S. contorta, p. 98
S. cesticillus, p. 97

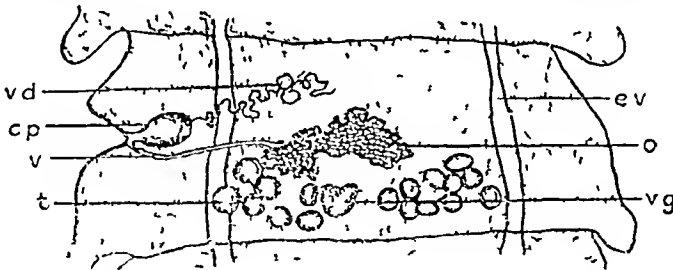


Fig 274 — *Raillietina (Skrjabinia) cesticillus* Mature segment, $\times 40$
(After Meggitt)

- (1) *Raillietina (Skrjabinia) cesticillus* (Mohn, 1858) (Fig 274)

Synonym — *Tania cesticillus*, Mohn, 1858

From (1) The domestic fowl, Berhampur, Bengal Southwell. Burma Meggitt (2) *Gallus sonnerati*, Zoological Gardens, Calcutta Southwell

* (7) *Raillietina (Paronella) contorta* Zschokke, 1895 From the common Indian Pangolin (*Manis pentadactyla*). This worm measures from 4 to 8 cm in length, and is differentiated by possessing two testes only

The worm attains a maximum length of 13 cm and a breadth of 3 mm. The genital pores are irregularly alternate and are situated in the anterior third of the margin of the segment. The rostellum is armed with from 400 to 500 hooks, each from 7 to 12 μ in length and arranged in two rows, the suckers are unarmed. There are from 20 to 30 testes, the cirrus sac extends median to the excretory vessels. The egg-capsules extend laterally as far as the excretory vessels and each contains a single egg. The larvæ occur in *Musca domestica* and in the ground beetle *Calathus opaculus*.

(2) *Raillietina* (*Skrjabinia*) *centropi* (Southwell, 1922) (Fig 275)

From the common caccal (*Centropus rufipennis*), Lake Tamblegam, Ceylon. Southwell

The worm measures from 2.5 cm in length and has a maximum breadth of about 1.5 mm. The segments are very much broader than long, all except a few at the posterior extremity.

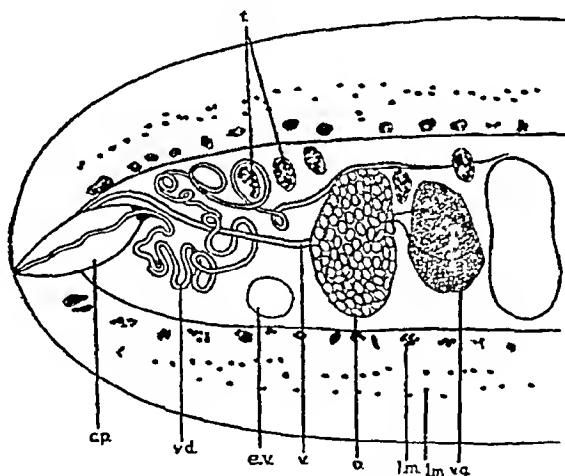


Fig 275 — *Raillietina* (*Skrjabinia*) *centropi*. Transverse section of poral half of mature segment, $\times 98$ (After Southwell)

being quite short. Their lateral posterior margins are salient. The genital pores are irregularly alternate, being situated and directed anteriorly. The head is prominent and presents a truncated appearance, it measures about 300 μ in breadth and merges into a very short neck. The suckers have a diameter of about 300 μ , and bear on their margins about 15 rows of hooks, each measuring about 8 μ . The rostellum is relatively small and is armed with about 300 hooks, each 9 to 11 μ in length, and arranged in a double row.

The muscular system is poorly developed, the longitudinal fibres are relatively scanty and consist of small bundles somewhat widely separated, which decrease in size externally. The transverse muscles lie internally to the longitudinal muscles and are also not very numerous, oblique or dorso-ventral fibres are few. A small single nerve-strand is situated laterally to the ventral excretory vessel on each side. On the pore side the nerve is ventral to the cirrus sac and the vagina.

The excretory system consists of a single ventral vessel on each side, on the pore side it lies ventrally to the cirrus sac.

The testes are about 40 in number, they are situated antero-dorsally on each side of the ovary, and extend laterally to the ventral excretory vessels. They are somewhat oval in shape and, when fully developed, measure about 85 by 55 μ . The vas deferens is remarkably long. It extends halfway across the segment, and is thrown into a large number of loops which occupy almost the entire field between the internal extremity of the cirrus sac and the poral wing of the ovary. Seminal vesicles apparently absent. The cirrus varies in length, extending from about half to three-quarters the distance between the lateral margin and the ventral excretory vessel.

The ovary is a relatively large bilobed organ situated postero-ventrally, in full development it extends almost to the dorsal transverse muscle-fibres. From the pore the vagina runs dorsally to the cirrus sac, at the internal extremity of the latter organ it curves gradually and runs directly to the ovary. It is muscular throughout its length, its internal extremity is dilated into a muscular receptaculum seminis which, when fully developed, measures about 150 μ in length and 50 μ in breadth. The oviduct, vitelline duct, and fertilization canal are also noticeable on account of their length. The vitelline gland lies ventrally to, and between, the two lobes of the ovary, it is large and easily seen. When fully developed, the uterus extends laterally to the ventral excretory vessels, and consists of a large number of parenchymatous capsules, each containing a single egg. The latter has a diameter of about 55 μ and the oncosphere about 36 μ .

Subgenus (d) *FUHRMANNETTA* Stiles & Orleman, 1926
(=*Johnstonia* Fuhrmann, 1920)

Raillietina in which the genital pores are irregularly alternate, and in which the egg-capsules each contain several oncospheres. Type-species — *Raillietina* (*Fuhrmannetta*) *crassula* (Rudolph, 1819)

Key to Species

- | | |
|---|---------------------------------|
| 1 Rostellum with a collar armed with spines | 2 |
| Rostellum without a collar armed with spines | 3 |
| 2 Egg-capsules extending laterally to excretory vessels | [p 101. |
| Egg-capsules not extending laterally to excretory vessels | <i>F pseudoechinobothrida</i> , |
| 3 Rostellum armed with 200 hooks measuring 12 to 13 μ | <i>F burmanca</i> , p 101 |
| Rostellum armed with 170 hooks measuring 18 to 20 μ | <i>F echinobothrida</i> , p 100 |
| | <i>F korhei</i> , p 102 |

(1) *Raillietina* (*Fuhrmannetta*) *echinobothrida* (Mégnin, 1880)
(Fig 276)

Synonyms — *Tænia echinobothrida* Mégnin, 1880

Tænia botriophytes Piann, 1881

Davainea par echinobothrida Magelhaes, 1898

From (1) The domestic fowl, Berhampur, Bengal Southwell Burma Meggitt (2) Jungle-fowl (*Gallus bankiva*), Berhampur, Bengal Southwell (3) *Gallus ferrugineus*, Zoological Gardens, Calcutta Southwell

The worm attains a length of 25 cm and a maximum breadth of 4 mm The genital pores are irregularly alternate and are

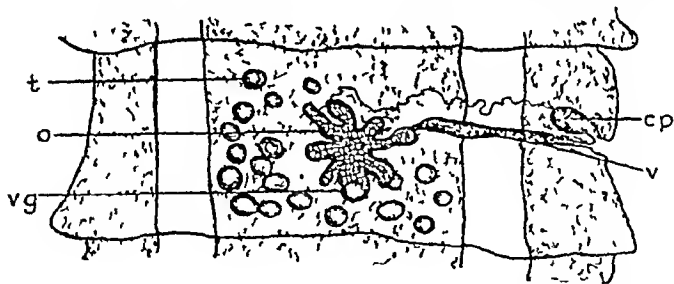


Fig 276 — *Raillietina* (*Fuhrmannetta*) *echinobothrida* Mature segment, $\times 53$ (After Meggitt)

situated in the posterior half of the margin of the segment The rostellum is armed with about 200 hooks arranged in two rows, each measuring from 10 to 13 μ The suckers are armed with from 8 to 10 rows of hooks, which vary in size from 6 to 15 μ There are from 20 to 30 testes, the cirrus sac, which measures from 13 to 18 μ , does not reach to the longitudinal excretory vessels The egg-capsules extend laterally to the excretory vessels and each contains from 6 to 12 eggs The latter vary in size from 25 to 50 μ Larval forms in *Helix maculosa*

(2) *Raillietina* (*Fuhrmannetta*) *pseudoechinobothrida* Meggitt, 1926

From the domestic fowl, Burma Meggitt

The worm measures from 8 to 9 cm in length and has a breadth of 1.8 mm. The genital pores are irregularly alternate, and are situated in the posterior half of the lateral margin of the segment. The rostellum is armed with about 200 hooks varying in size from 8 to 12 μ and arranged in two rows. Immediately posterior to the rostellum there is a collar thickly studded with minute spines. It is not known whether the suckers are armed or not.

There are from 30 to 50 testes, and the cirrus sac does not reach to the longitudinal excretory vessels. The egg-capsules extend laterally to the longitudinal excretory vessels, and each contains 3 or 4 eggs. The species is closely related to *R. echinobothrida*, from which it differs in having a larger number of testes and fewer eggs in each capsule.

(3) *Raillietina* (*Fuhrmannetta*) *birmanica* Meggitt, 1926.
(Fig. 277)

From the domestic fowl, Burma Meggitt

The worm measures from 8 to 10 mm in length and has a breadth of from 1 to 2 mm. The genital pores are irregularly alternate and are situated in the anterior half of the margin of

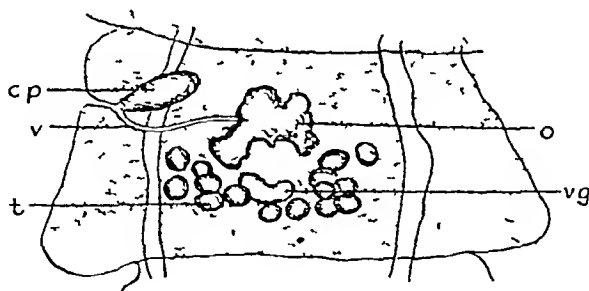


Fig. 277 — *Raillietina* (*Fuhrmannetta*) *birmanica* Mature segment, $\times 53$ (After Meggitt)

the segment. The rostellum is armed with about 300 hooks arranged in two rows, the large ones measuring 12 μ and the small ones 9 μ . Immediately behind the rostellum there is a collar thickly studded with minute spines similar to that which occurs in *R. torquata* and *R. frontina*. It should be noted, however, that this collar is only visible in living worms. The suckers are unarmed.

There are from 20 to 25 testes in two lateral groups connected by a single posterior row, the aporal row being the larger. The cirrus pouch is large and extends median to the excretory vessel. The egg-capsules each contain several eggs, and do not extend laterally to the excretory vessels.

(4) *Railhietina* (*Fuhrmannetta*) *korkei* Joyeux & Houdemer, 1928 (Fig 278)

From pigeons, Kasauli, India

The gravid worm measures 164 mm in length and has a breadth of 2 mm. The genital pores are apparently irregularly alternate. The scolex has a length of $175\ \mu$ and a breadth of $200\ \mu$, the rostellum is dome-shaped, $85\ \mu$ in height, and 120 to $130\ \mu$ in breadth. It bears 150 to 160 hammer-shaped hooks, each measuring from 18 to $20\ \mu$ in length and clearly placed in a double row. The suckers have a diameter of from 60 to $70\ \mu$ and are armed with several rows of spines, the

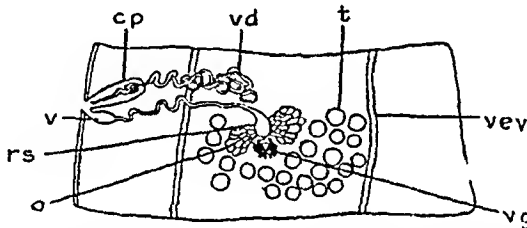


Fig 278 --*Railhietina* (*Fuhrmannetta*) *korkei* Mature segment, magnification unknown (After Joyeux and Houdemer)

smaller ones being deciduous, they vary in size, the largest being $10\ \mu$. The neck has a length of 6 or 7 mm. The musculature is well developed, the longitudinal fibres are numerous, sometimes in three or four layers. The transverse muscles consist of three or four concentric fibres. The dorso-ventral muscles are composed of numerous fine fibres ramifying through the entire cortical parenchyma.

There are 24 testes, 17 being aporal and 7 poral, each measures $35\ \mu$ in diameter. Seminal vesicle present on coiled vas deferens. The cirrus sac measures about $110\ \mu$ and does not reach the ventral vessel, and there is no internal seminal vesicle. The cirrus is unarmed.

The vagina is posterior to the male orifice and is short and wide, a receptaculum seminis is present. There are from 50 to 66 egg-capsules in each segment, extending laterally to the excretory vessels. Each measures $170\ \mu$ and contains from 6 to 9 eggs, which are 18 by $14\ \mu$ in diameter.

The following species of *Raillietina* cannot be placed in any of the above subgenera owing to our lack of knowledge of anatomical details concerning them —

(1) *Raillietina anatina* (Fuhmann, 1909)

From (1) pigeons (*Columba* sp.) and (2) the green pigeon (*Crocopus phœnicopterus*), both from Chilka Lake, Orissa, India Southwell

Fully mature worms have not been described, the worm attains a length of 1.5 cm and a breadth of 1.5 mm. The genital pores are regularly alternate. The scolex has a diameter of from 400 to 500 μ . The rostellum, which has a breadth of from 160 to 200 μ , is armed with about 300 hooks, each measuring from 14 to 16 μ in length and arranged in a double row. The suckers are unarmed. There are from 16 to 18 testes

(2) *Raillietina reynoldsæ* Meggitt, 1926 (Fig. 279)

From *Corvus splendens insolens*, Rangoon Meggitt

The worm attains a length of 25 cm and a maximum breadth of 300 μ . The genital pores are situated at the anterior third of the margin of the proglottis. The scolex has a diameter of 380 μ and the rostellum 110 μ . The latter is armed with a double circle of hooks, about 250 in all, each measuring from



Fig. 279 — *Raillietina reynoldsæ* Mature segment, $\times 40$
(After Meggitt, in 'Parasitology')

11 to 17 μ in length. Surrounding the rostellum there is a spiny collar 180 to 210 μ in diameter. The suckers are armed with five rows of hooks which diminish in size towards the centre of the sucker.

Male Genitalia The testes are clearly separated into two groups, from 7 to 12 being paral and 26 to 27 aporal. The cirrus sac measures from 130 to 212 μ in length, increasing in size posteriorly. Having regard to the wide range in size of this organ, Meggitt states that "measurements without mention of maximum size and portion of body are useless," and with this remark the writer agrees. The cirrus sac crosses the nerve, but does not reach the excretory vesicle, this character being more constant than the size of the organ.

Female Genitalia The ovary is much lobed, the egg-capsules each contain a single egg and extend laterally to the excretory vessels, in gravid segments they reach to the subcuticula.

This species is closely related to *Raillietina* (*Paromella*) *corvina* (Fuhrmann, 1905), from which it differs, however, in the greater number and smaller size of the rostellar hooks and also in the large size of the cirrus sac.

Meggitt points out that "In one crow containing numerous examples of this species, the wall of the posterior portion of the intestine was studded with numerous small tubules, 3 mm in diameter, some level with and hardly to be distinguished from the intestine, others spherical or ellipsoidal and only attached to it by thin threads. The former contained scoleces of *T. reynoldsæ*, entirely separated from the lumen of the intestine and from any strobila. The latter were extremely tough, consisting of several strata surrounding a central cavity containing pus and a larval tapeworm. The tapeworm was solid, containing a few calcareous corpuscles and numerous oil globules, a few brown, but the majority colourless, scolex hooks were entirely absent. The penetration of cestode scoleces into the intestinal wall has already been recorded in the cases of *Raillietina* (*Fuhrmannetta*) *echinobothrida* (Mégnin, 1880) and *R. penetrans* (Baczynska, 1914). No record exists of any larval form in the intestinal wall of birds."

(3) *Raillietina fatalis* Meggitt, 1927

From (1) *Nesocia bengalensis* and (2) *Rattus norvegicus*, Rangoon. Meggitt.

The worm attains a length of 19 cm and a breadth of 4.5 mm. All the segments are broader than long, the strobila being somewhat pointed posteriorly. It is not known whether the genital pores are unilateral or irregularly alternate. The scolex may attain a diameter of 600 μ . The rostellum has a breadth of from 140 to 170 μ , with about 180 hooks, each measuring from 23 to 32 μ in length and arranged in a double row. Immediately behind the rostellum there is a spiny collar. The suckers are armed with about 6 rows of hooks, each hook measuring about 4 μ .

A ventral excretory plexus is present with three or four long vessels. According to Meggitt, there are from 38 to 43 testes of which from 15 to 26 are aporal and 13 to 22 poral. They are situated mostly between the two outermost longitudinal excretory vessels. The cirrus sac measures about 105 by 70 μ in immature segments, and does not reach the nerve. The egg-capsules are too numerous to count, being extremely small and tightly packed together, they extend laterally to the excretory vessels and nerve, and each contains a single egg, so that a gravid proglottid presents a granular appearance in whole mounts.

(4) *Railhetina fluxa* Meggitt, 1927

From *Rattus norvegicus*, Rangoon Meggitt

The worm attains a length of 1.3 cm and a breadth of 1 mm. The genital pores are irregularly alternate. The scolex has a diameter of about $626\ \mu$ and the rostellum of $195\ \mu$, the latter is armed with about 156 hooks, each from 18 to $22\ \mu$ in length and arranged in a double row. Immediately behind the rostellum there is a spiny collar. The suckers are unarmed. There are from 19 to 21 testes, of which 7 are poral and from 12 to 14 aporal. Gravid segments unknown.

(5) *Railhetina funebris* Meggitt, 1927

From *Rattus norvegicus*, Rangoon Meggitt

The worm attains a length of 3 cm and a breadth of $760\ \mu$. The genital pores are unilateral and are situated at the anterior third of the lateral margin of the segment. The scolex has a diameter of from 410 to $580\ \mu$ and the rostellum from 105 to $171\ \mu$, the latter is armed with from 80 to 100 hooks, each measuring from 17 to $21\ \mu$ in length and arranged in a double row. The suckers are unarmed. There are from 35 to 40 testes surrounding the female glands on all sides except dorsally and in the space occupied by the genital ducts. The currus sac measures from 105 to $121\ \mu$ by from 48 to $54\ \mu$, and extends just median to the nerve in young segments and to the excretory vessels when mature, gravid segments are unknown.

The species is closely related to *R. madagascariensis* and *R. gracilis*. It differs from both in the absence of acetabular hooks, from *R. madagascariensis* in having fewer testes, and from *R. gracilis* in the position of the genital pore.

(6) *Railhetina indica* Meggitt, 1927

From *Nesocia bengalensis*, Rangoon Meggitt

This species was described from a single immature specimen, the size of which is not stated. The genital pores are irregularly alternate. The scolex has a diameter of $820\ \mu$ and the rostellum of $240\ \mu$, the latter is armed with from 250 to 260 hooks, each measuring from 22 to $25\ \mu$ and arranged in a double row. Immediately behind the rostellum there is a spiny collar. The suckers are armed with from about 6 to 7 rows of hooks diminishing in size internally and measuring about 2 or $3\ \mu$.

SPECIES INQUIRENDÆ

(1) *Railhetina* sp. Southwell, 1922

From pigeons (*Columba* sp.), Berhampur, Bengal. Southwell. A fragment without a head was obtained from this host.

(2) *Railletina* sp Southwell, 1922

From pigeons (*Columba* sp), Berhampur, Bengal Southwell

This second species, also without a head, from the same host, measured 15 cm in length and 3 mm in breadth, the egg-capsules extended laterally to the excretory vessels, and each contained three or four eggs

It is impossible to determine the species to which the above two specimens belong

(3) *Railletina* sp Southwell, 1922

From a crow pheasant, Zoological Gardens, Calcutta Southwell

A few fragments without heads

(4) *Railletina* sp Meggitt, 1926

From *Gallus ferrugineus*, Victoria Memorial Park, Rangoon. Meggitt

The worm attains a length of 8 mm and a breadth of $300\ \mu$, it contains about 30 proglottides, the terminal ones being longer than broad, all the segments are either immature or sterile, i.e., devoid of any trace of genital organs

The scolex measures $190\ \mu$ in diameter, the rostellum, which has a diameter of $43\ \mu$, is armed with a single crown of about 100 hooks, which measure from 11 to $13\ \mu$, the suckers are unarmed Meggitt points out that no species of this genus possessing these characters has been recorded from Galliformes, and only *R. columbae* (Fuhrmann, 1908) from birds in general, but, having regard to the scanty information available regarding this worm, he deemed it inadvisable to create a new species

(5) *Railletina* sp (? *paradisea* Fuhrmann, 1908)

From pigeons, Zoological Gardens, Calcutta Southwell

A single specimen, consisting of a head and a few anterior segments, was obtained The rostellar hooks were in a double row, each hook measuring about $23\ \mu$ Apparently the only species with hooks approximately of this size are *D. paradisea* Fuhrmann, 1908, and *D. conopophila* Johnston, 1911 The identity of the parasite is, however, quite uncertain

(6) Moghe (1926) records undetermined species of *Railletina* from (1) the domestic fowl, (2) *Cypselus affinis*, and (3) *Turtur cambayensis*, India

Genus IV COTUGNIA Diamare, 1893

Segments are broader than long. A double set of reproductive organs in each proglottis close to the longitudinal excretory canals. Genital ducts pass dorsally to the longitudinal excretory vessels and nerve. Testes numerous, generally posterior, and extending laterally to the extreme edge of the medullary parenchyma. Uterus breaks down and eggs become enclosed singly in egg-capsules. Adults in birds.

Type-species — *Cotugnia digonophora* (Pasquale, 1890)

Key to Species

- | | |
|--|--|
| 1 Rostellum much smaller than suckers | <i>C margarita</i> , p 110 |
| Rostellum approximating in size to suckers | 2 |
| 2 Rostellum armed with a single row of hooks | <i>C digonophora</i> , p 107 |
| Rostellum armed with a double row of hooks | 3 |
| 3 Hooks alternately of two different sizes | |
| a Posterior segments longer than broad, musculature weakly developed | <i>C cuneata</i> var <i>tenuis</i> , p 112. |
| b Posterior segments broader than long, musculature strongly developed | <i>C cuneata</i> var <i>neriosa</i> , p 113. |
| Hooks all of one size | 4 |
| 4 Hooks not more than 12μ length | 5 |
| Hooks more than 12μ in length | 6 |
| 5 Testes extending laterally to excretory vessels | <i>C biotogenys</i> , p 109 |
| Testes rarely extending to excretory vessels | <i>C seni</i> , p 113 |
| 6 Suckers unarmed | <i>C fastigata</i> , p 111 |
| Suckers armed | <i>C fulmanni</i> , p 108 |

(1) *Cotugnia digonophora* (Pasquale, 1890) (Fig 280)

Synonyms — *Tænia digonophora* Pasquale, 1890

Cotugnia bifaria Southwell, 1922

From (1) Ducks, Zoological Gardens, Calcutta Southwell.

(2) Domestic fowl, Berhampur, Bengal Southwell (3) Somett's jungle fowl, Victoria Memorial Park, Rangoon. Meggitt

The worm attains a maximum length of about 8 cm and a breadth of 8 mm. It has a thickness of about 1 mm. The head measures about 1.4 by 1.1 mm, the rostellum bears an enormous number of minute hooks arranged in a single row, each hook measuring about 8μ . The suckers are cup-shaped, prominent, and have a diameter of about 450μ . The neck is

short or absent. The anterior segments are broader than long, but they gradually elongate and the posterior ones are longer than broad. The genital pores are double in each segment, and are situated about the middle of the lateral margin. Each segment contains a double set of genital organs.

The cirrus sacs are cylindrical, and extend about half the distance between the lateral margin of the segment and the excretory vessels on each side. The vas deferens is thrown

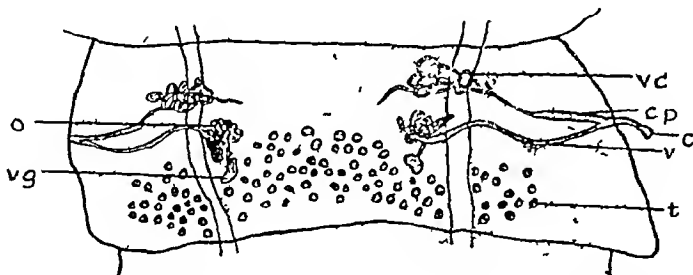


Fig 280 — *Cotugnia digonophora* Mature segment, $\times 175$
(After Meggitt)

into a number of loose coils in front of each ovary in the vicinity of these vessels.

There are about 100 testes situated posteriorly to the ovaries, extending in a single broad field laterally to the excretory vessels on each side.

There are two ovaries in each segment, one being situated just median to each excretory vessel, and behind each there is a conspicuous vitelline gland. The egg measures about 60μ .

(2) *Cotugnia fuhrmanni* Baczyńska (Fig 281)

From *Pavo cristatus*, Ceylon. Fuhrmann's Collection.

The worm attains a length of from 6 to 8 cm and a breadth of 2.5 mm. All the segments are broader than long, the mature ones measure 390μ in length and 1.78 mm in breadth. The genital pores are double in each segment and are situated in the middle third of the lateral margin. The scolex has a length of 400μ and a breadth of 560μ . The suckers have a diameter of about 180μ and their margins are armed with numerous minute hooks. The rostellum has a breadth of 86μ and bears about 170 hooks, each having a length of about 15μ , and arranged in a double row.

The longitudinal muscles are distributed in two layers of bundles, the inner ones being much more strongly developed than the outer. The transverse muscles are also well developed, and consist of three layers, viz, one internally to the internal longitudinal bundles, another between the inner and outer,

and the third externally to the outer longitudinal bundles. In addition, isolated fibres occur in the cortex, the musculature thus resembles that found in species of the subfamily Acoleinæ. The excretory vessels are situated a considerable distance from the lateral margin of the segment.

There are from 60 to 70 testes in each segment, occupying the posterior part and extending laterally to the excretory vessels. They are absent in the anterior part. The undulations of the vas deferens are surrounded by glandular prostatic cells. The cirrus sac is narrow and elongated, presenting a tubular appearance, it has a length of $470\ \mu$ and a breadth of $39\ \mu$, and extends slightly median to the excretory vessels. The cirrus is very muscular.

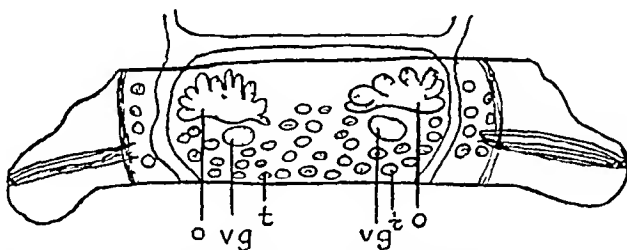


Fig 281 — *Cotugnia fuhrmanni*. Mature segment, magnification unknown (After Baczyńska)

Each ovary is strongly lobed and has a length of $65\ \mu$ and a breadth of $185\ \mu$, the lateral margin of each almost touches the excretory vessels. The vitelline gland has a length of $90\ \mu$ and a breadth of $400\ \mu$, it lies posteriorly and ventrally to the ovary. The shell gland is dorsal to the vitelline gland, it has a diameter of $78\ \mu$. The vagina opens into the genital atrium anteriorly and ventrally to the cirrus sac, its course is somewhat undulated; median to the excretory vessel it dilates into a small fusiform receptaculum seminis, which has a length of about $170\ \mu$. The terminal (lateral) part of the vagina is surrounded with glandular cells. The uterus is at first a simple sac situated dorsally, later, its walls disappear and the eggs become isolated in the parenchyma. Capsules are formed, each containing a single egg, they extend laterally to the excretory vessels. Fully mature eggs are not known.

(3) *Cotugnia brotogeris* Meggitt, 1915

From *Platyercus eximius*, Rangoon. Meggitt

The worm attains a length of 7.5 cm and a maximum breadth of 2 mm. The mature segments measure about 1.55 mm in length and 1.77 mm, in breadth, gravid segments have a

length of 1.72 mm and a breadth of about 2.57 mm. The posterior margin of each segment overlaps the anterior margin of the succeeding segment, slightly anteriorly and to an increasing extent posteriorly. The genital pores are situated in the anterior third of the lateral margins of the segment. The head is almost spherical and has a diameter of about $430\ \mu$, the rostellum has a diameter of $150\ \mu$, and is armed with numerous hooks arranged in a double row, each having a length of about $12\ \mu$. The musculature consists of three longitudinal layers which alternate with three layers of transverse fibres.

The testes are numerous, in a double row, occupy the centre of the segment, and extend laterally to the excretory vessels. The cirrus sac is small and reaches to the longitudinal excretory vessels. The ovary consists of a number of short thick lobes arranged fanwise. The vitelline gland is a slightly lobed organ $66\ \mu$ in length and $113\ \mu$ in breadth, consisting of a number of follicles surrounding a cavity, it lies posteriorly to the ovary. The vagina opens into a genital atrium, it runs postero-transversely, bending once or twice, and dilates just internally to the longitudinal excretory vessel into a large spherical receptaculum seminis. The uterus is not persistent, the eggs becoming enclosed in capsules, each containing several eggs.

Fig 282

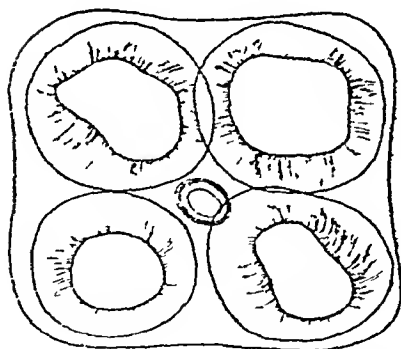
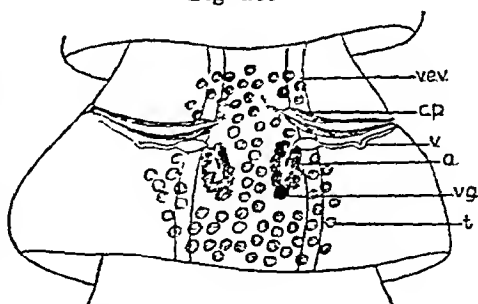


Fig 283



Cotugnia margareta

Fig 282 —Head, viewed en face, $\times 80$ (Original)

Fig 283 —Mature segment, $\times 28$ (Original)

(4) *Cotugnia margareta* Beddard, 1916 (Figs 282 & 283)

Synonym — *Cittotænia avicola* Southwell, 1922

From (1) Crows (*Corvus macrorhynchus*), Zoological Gardens, Calcutta. Southwell (2) A moonal pheasant (*Lophophorus refulgens*); Zoological Gardens, Calcutta. Southwell

This species is differentiated from all others of the genus by the fact that the rostellum is smaller than the suckers. Beddard obtained it from a pheasant. In the specimens from the Indian crow the rostellum was also smaller than the suckers, and the worm could not be distinguished from *C. margareta* Beddard, 1916.

Fig 284

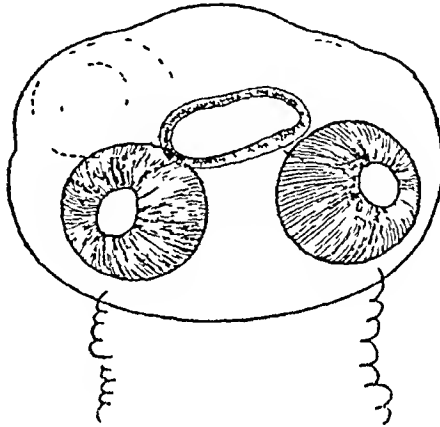
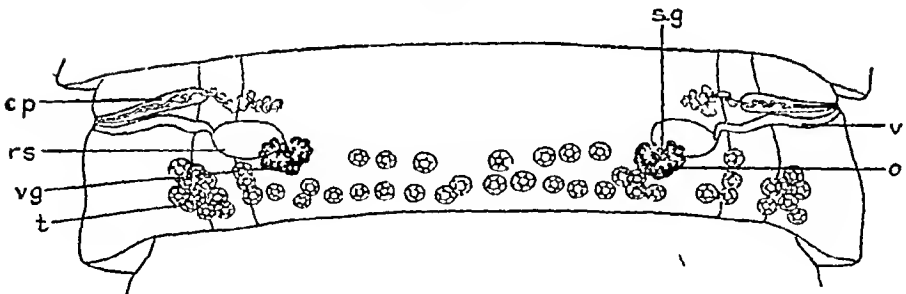


Fig 285



Cotugnia fastigata

Fig 284 — Head, $\times 80$ (Original)

Fig 285 — Mature segment, $\times 47$ (Original)

(5) *Cotugnia fastigata* Meggitt, 1920 (Figs 284 & 285)

From (1) Domestic ducks; Rangoon Meggitt (2) A parrot (*Phistes coccineopterus*), Zoological Gardens, Calcutta Southwell

The worm measures 3 cm in length and the maximum breadth is 6 mm. All the proglottides are broader than long. The strobila is triangular, the head measures from 500 to 600 μ in diameter and is provided with four unarmed suckers and an armed rostellum. The latter has a diameter of about

300 μ and bears approximately 200 hooks, each about 20 μ in length, and arranged in a double row

The musculature consists of three longitudinal layers, each of which is bounded internally by a thin band of transverse muscles. The most internal longitudinal layer consists of large irregular bundles, and the outermost of fibres extending to the cuticle.

Dorsal longitudinal excretory vessels are absent in mature segments. The genital pores are situated laterally in the anterior quarter of the segment.

The testes are distributed as a narrow band consisting of two or three rows along the posterior margin of the proglottis. Laterally they surround the ventral excretory vessel, and extend as far as the nerve. The cirrus sac is long and narrow and reaches the nerve. Between the sac and the testes the vas deferens, which is surrounded by numerous gland-cells, is thrown into a closely packed coil.

The ovary is deeply lobulated. It is asymmetrical, and lies postero-ventrally to the receptaculum seminis, close to the excretory vessel. The vitelline gland is small, compact, and situated posteriorly and slightly aporally to the ovary, it is surrounded laterally by testes. The vagina is short, almost straight, and the receptaculum seminis is small and spindle-shaped. The uterus at first consists of a narrow branched tube situated anteriorly to the ovary, but it soon disappears, and the eggs come to lie singly in parenchymatous capsules.

Meggitt recorded this species from ducks, the writer obtained it from a parrot. In the latter case the worms agreed in detail with Meggitt's description of this species, and the writer has no option but to consider them identical, even though the hosts are so widely different.

(6) *Cotugnia cuneata* var. *tenuis* Meggitt, 1924

From pigeons (*Columba* sp.), Rangoon. Meggitt.

The worm measures 3 cm. length and the maximum breadth is 1 mm. The scolex has a diameter of 260 μ and the rostellum is armed with a double circle of about 200 hooks, 14 and 18 μ in length, the long and short ones alternating. Behind the rostellum there is a circular cushion, the suckers are unarmed. Posteriorly the proglottides are longer than broad. The genital pores are situated near the middle of the margin of the proglottis.

The musculature is weakly developed and consists of two layers of longitudinal muscles each between two transverse ones. The inner longitudinal layer consists of about 15 dorsal and 15 ventral bundles.

The testes are situated in the posterior half of the segment, and a few occasionally extend laterally to the longitudinal excretory vessels. The cirrus sac is large, often extending internally to the longitudinal excretory vessel, the vas deferens forms a number of coils immediately median to the cirrus sac.

The two lobed ovaries lie posteriorly to the cirrus sacs close to the longitudinal excretory vessel and often close together. Each ovary presents a deep concavity directed posteriorly. The vagina is a short curved duct situated, like all the genital organs, posteriorly to the cirrus. The eggs occur singly in thick-walled capsules which extend laterally to the excretory vessels.

(7) *Cotugnia cuneata* var. *nervosa* Meggitt, 1924

From (1) Pigeons (*Columba* sp.), Rangoon. Meggitt. Kasauli, India. Joyeux and Houdemer. (2) Red turtle-doves, Nagpur, Central Provinces, India. Moghe.

This variety resembles var. *tenuis* closely, it differs in being much larger, in the segments being broader than long, and in the musculature being strongly developed.

The worm measures up to 6 cm. in length and 3 mm. in breadth. It appears doubtful whether these two so-called varieties can be differentiated either from each other or from *C. cuneata*.

(8) *Cotugnia seni* Meggitt, 1926

From *Platycercus eximius*, Victoria Memorial Park, Rangoon. Meggitt.

The worm measures 10 mm. in length and has a maximum breadth of 1 mm. The specimens hitherto obtained have been mature but not gravid. All the proglottides are broader than long. The genital pores are situated in the anterior margin of the proglottis at the bottom of a shallow genital atrium. The scolex measures from 350 to 360 μ in diameter and the rostellum from 210 to 270 μ , the latter is armed with a single row of about 200 hooks, each of which measures from 10.5 to 12.5 μ in length, the suckers are unarmed.

The testes vary in number from 30 to 40, forming a single broad transverse band rarely extending laterally to the excretory vessels, and situated behind the female glands. The cirrus sac is slender, measuring 190 μ in length and extending just median to the excretory vessels, the coils of the vas deferens are few in number.

The ovary and vitelline gland are prominently lobed, the receptaculum seminis is large and spherical.

Subfamily II OPHRYOCOTYLINÆ, Fuhrmann,
1907

Rostellum very large and armed with two rows of hooks
Uterus persistent Adults in birds

Type-genus —*Ophryocotyle* Frus, 1870

Genus OPHRYOCOTYLE Frus, 1870

Rostellum armed with hooks arranged in two rows of wavy lines
Suckers armed anteriorly only with four rows of hooks
Genital pores alternate

Type-species —*Ophryocotyle proteus* Frus, 1870

Ophryocotyle zeylanica Linstow, 1906 (Fig 286)

From the Ceylonese hornbill (*Lophoceros gingalensis*),
Nedunkeni, Northern Provinces, Ceylon ? Willey

The worm attains a length of about 5.5 cm and a maximum breadth of 700 μ . The posterior segments are longer than broad. According to Clausen (1915) the genital pores are usually regularly alternate. The scolex is almost square, having a breadth of 250 μ . The neck measures 1 mm in length. The rostellum is well developed and somewhat button-shaped, it bears a large number of hooks arranged in a double row, each row being markedly undulated. The hooks measure 10 μ in length and resemble those of the genus *Railletina*. The suckers are armed anteriorly with minute hooks. On each side the ventral excretory vessel is larger than the dorsal. The longitudinal muscles are disposed in two layers of bundles, the inner one being much more strongly developed than the outer.

There are about 18 testes, situated at the extreme posterior margin of the segment. The cirrus sac is strongly developed, measuring 140 by 47 μ and extending beyond the ventral excretory vessel. Both genital ducts pass between the excretory vessels and dorsally to the nerve, the vagina lies ventrally to the cirrus sac. An internal seminal vesicle is present.

The ovary is very strongly developed, lobed, and situated in front of the testes, behind it, and ventrally, lies the vitelline gland, the shell gland is small, measuring 25 μ . The vagina opens, with the vas deferens, into a genital atrium, its terminal part being dilated and surrounded with cells. Near the dorsal excretory vessel, and median to it, this organ expands

into a conspicuous receptaculum seminis. The uterus is very voluminous and fills the entire internal parenchyma. It is divided up by partitions, and persists in the ripe segments

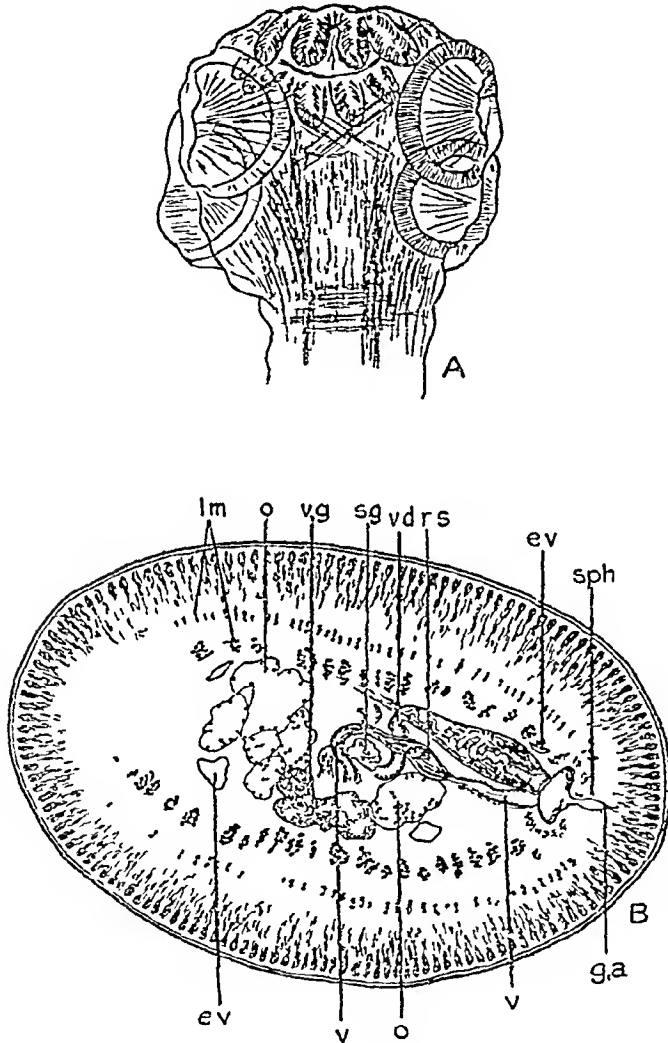


Fig 286 — *Ophryocotyle zeylanica* A, head, B, transverse section of mature segment, magnification unknown (After Clausen)

in the form of a lobed sac, in this respect it differs from species of *Raillietina* because in the latter genus the uterus is replaced by capsules. Mature eggs unknown.

Family IV HYMENOLEPIDIDÆ Railliet & Henry, 1909

Fuhrmann (1907) placed in this family, which he called Hymenolepinae, the genera *Ohgorchus*, *Diorchus*, *Aploparaksis*, and *Hymenolepis* (with the subgenus *Echinocotyle*). At the same time he erected another family, viz., Dilepinae, with the three subfamilies Dilepinae Fuhrmann, 1907, Dipylidinae Railliet, 1896, and Paruterinae Fuhrmann, 1907. In 1926 he retained his earlier classification in its broad outlines, but he united the family Fimbriaridae Wolff, 1898 (containing the single genus *Fimbriaria* Frohlich, 1802) with the family Hymenolepididae Railliet & Henry, 1909. He also removed the genus *Diploposthe* Jacobi, 1896, from the family Acolecidae Ransom, 1909, and placed it in the Hymenolepididae Railliet & Henry, 1909, on the ground that the species of this genus (viz., *D. laevis* Bloch, 1782) usually, but not invariably, has three testes in each segment. Ransom placed the genus *Diploposthe* Jacobi, 1896, in the family Tænidae Ludwig, 1886. Following Meggitt (1924) and Mayhew (1925), the genus *Diploposthe* is here placed in the family Acolecidae Ransom, 1909.

Ransom (1909) united the two families Dilepinae Fuhrmann, 1907, and Hymenolepididae Railliet & Henry, 1909, into one family, viz., Hymenolepididae Railliet & Henry, 1909. He also united, under the name Dipylidinae Stiles, 1896, the two subfamilies Dilepinae Fuhrmann, 1907, and Dipylidinae Stiles, 1896. Therefore, in Ransom's classification the family Hymenolepididae Railliet & Henry, 1909, contains two subfamilies, viz., Dipylidinae Stiles, 1896, and Paruterinae Ransom, 1909.

Meggitt (1924) divided the family Hymenolepididae Railliet & Henry, 1909, into five subfamilies, viz., Hymenolepinae Ransom, 1909, Dipylinae (sic) Stiles, 1896, Dilepinae Fuhrmann, 1907, Paruterinae Ransom, 1909, and Fimbriarinae Meggitt, 1924.

Mayhew (1925) accepts Fuhrmann's restriction of the family Hymenolepididae (Ariola, 1899), and he divides the family up as follows —

Subfamily 1 Hymenolepididae (Perrier, 1897) Ransom 1909 (emended) (apparently a misprint for Hymenolepinae Perrier, 1896). With three testes in each proglottis. Type genus — *Hymenolepis* Weiml, 1858.

The old genus *Hymenolepis* he divided into three genera, viz. — (1) *Hymenolepis* Weimland, 1858, with three testes in a transverse row. Type-species — *Hymenolepis diminuta*

(Rudolphi, 1819) (2) *Weinlandia* Mayhew, 1925, in which one testis is poral and two aporal, of the latter, one is anterior to the other Type-species — *Weinlandia macrostrobilodes* Mayhew, 1925 (3) *Wardium* Mayhew, 1925, in which the testes are variable in position Type-species — *Wardium fryeri* Mayhew, 1925 He also includes the genera *Fimbriaria* Frohlich, 1802, *Echinorhynchotænia* Fuhrmann, 1909, and *Hymenofimbria* Skrjabin, 1914, in this subfamily

Subfamily 2 Oligorchinæ With four testes in each proglottis Type and only genus — *Oligorchis* Fuhrmann, 1906

Subfamily 3 Diorchinæ With two testes in each proglottis Type and only genus — *Diorchis* Clerc, 1903

Subfamily 4 Haploparaxinæ With regularly a single testis in each proglottis Type and only genus — *Haploparaxis* Clerc, 1903 = *Aploparaksis* Clerc, 1903

Meggitt (1927) notes that Mayhew has erected three subfamilies for three genera, he does not accept this classification, and at the same time he points out that the division of the old genus *Hymenolepis* into the three genera, *Hymenolepis*, *Weinlandia*, and *Wardium*, according to the position of the testes, is unsatisfactory He calls attention to the four following facts (1) that the type-species of the genus *Hymenolepis* is *H. diminuta* (Rud, 1819), (2) that in this species the testes are inconstant in position, (3) that constancy in the arrangement of the testes may not exist within the subfamily, and (4) that, in any case, in actual practice the system is unworkable He accordingly does not accept Mayhew's genera *Wardium* and *Weinlandia*

In the genus *Hymenolepis* the rostellum is usually armed with a single crown of hooks, more rarely it is unarmed The writer (1921) described under the name *Dilepis kempri* a worm in which the rostellum bears 20 hooks in two rows, and in which the mature segments have three testes Mayhew placed the worm in the genus *Hymenolepis* because the species possesses three testes, even though the head bears a double row of hooks

Fuhrmann's classification of the family is adopted below —

Hymenolepididæ Railliet & Henry, 1909 Scolex usually furnished with a rostellum armed with a single row of hooks, rarely with a double row, or unarmed Segments always broader than long, genital pores unilateral, rarely double Genital ducts pass dorsally to the excretory vessels and nerve Testes few, from one to four The vas deferens is always dilated into an internal and an external seminal vesicle Uterus sac shaped, rarely reticular Eggs with three envelopes Type-genus — *Hymenolepis* Weinland, 1858

The family is represented in India by the genera *Hymenolepis* Weinland, 1858 (with the subgenus *Echinocotyle* Blanchard, 1891), and *Fimbriaria* Frohlich, 1802. The writer does not accept Mayhew's genera *Wardium* and *Weinlandia*.

Key to Genera

- | | |
|--|--------------------|
| Strobila not segmented externally, but with transverse grooves, pseudoscolex present | FIMBRIARIA, p 151 |
| Strobila definitely segmented, pseudoscolex absent | HYMENOLEPIS, p 118 |

Genus I HYMENOLEPIS Weinland, 1858

Synonyms --*Diplacanthus* Weinland, 1858

Lepidotrias Weinland, 1858

Diepamidotæma Raillet, 1892

Dicranotania Raillet, 1892

Thiorchis Clerc, 1903

Rostellum generally well developed and armed with a single crown of hooks (a double crown in *H. kempi* (Southwell, 1921) and *H. ficticia* Meggitt, 1927), sometimes rudimentary and unarmed. Suckers in adult generally unarmed, rarely armed with hooklets or fine spines. Testes three in each segment. Vas deferens with internal (i.e., inside the cirrus sac) as well as external seminal vesicle (outside the cirrus sac). Sacculus accessorius generally absent. Adults in mammals and birds.

Type-species —*Hymenolepis diminuta* (Rud., 1919) Blanchard, 1891

Key to Species

- | | |
|--|-----------------------------------|
| 1 Scolex unarmed | 2. |
| Scolex armed | 3 |
| 2 Testes median to excretory vessels | |
| a Parasites of rats | <i>H. diminuta</i> , p 119. |
| b Parasites of fowl | <i>H. rustica</i> , p 141 |
| Testes external to excretory vessels | <i>H. phalacrocorax</i> , p 143. |
| 3 Hooks in two rows | 4 |
| Hooks in a single row | 5 |
| 4 20 hooks 135 and 175 μ | <i>H. kempi</i> , p 127 |
| 24 hooks 45 and 50 μ | <i>H. ficticia</i> , p 141 |
| 5 Rostellum armed with 8 hooks | 6 |
| Rostellum armed with 10 hooks | 7 |
| Rostellum armed with 12 or more hooks | 8 |
| 6 Rostellar hooks 110 to 130 μ | <i>H. liguloides</i> , p 132 |
| Rostellar hooks 90 μ | <i>H. megalorchis</i> , p 136 |
| Rostellar hooks 88 to 95 μ | <i>H. rugosa</i> , p 126 |
| Rostellar hooks 76 to 82 μ | <i>H. gracilis</i> , p 130 |
| Rostellar hooks 72 μ , peculiarly shaped, in pigeons | <i>H. sphenoccephala</i> , p. 131 |
| Rostellar hooks 57 μ | <i>H. clausa</i> , p 126 |
| Rostellar hooks 30 to 35 μ | <i>H. lanceolata</i> , p 121 |
| 7 Rostellar hooks 30 to 36 μ , eggs 60 μ | <i>H. zosteropsis</i> , p 137 |
| Rostellar hooks 32 μ , eggs 17 μ | <i>H. annandalei</i> , p 139. |
| Rostellar hooks 28 μ | <i>H. spinosa</i> , p 124 |

Rostellar hooks 18 to 23 μ	<i>H. farciminosa</i> , p 129
Rostellar hooks 16 μ	<i>H. fusa</i> , p 124
8 With 12 rostellar hooks 16 to 18 μ	<i>H. minutissima</i> , p 142
With 16 rostellar hooks 16 μ	<i>H. solitaria</i> , p 142
With 20 hooks 12 to 17 μ —	
a Worms 3 cm in length	<i>H. simplex</i> , p 137
b Worms 12 to 19 cm in length	<i>H. coronula</i> , p 132
With 22 hooks 30 to 34 μ	<i>H. mediei</i> , p 135
With 25 hooks 19 to 24 μ	<i>H. furcata</i> , p 134
With 24 to 28 hooks 14 to 18 μ	<i>H. minima</i> , p 122

Not included in Key

Hooks unknown	<i>H. septaria</i> , p 125
Hooks 20 to 24 μ , number unknown	<i>H. clerici</i> , p 144

In the differentiation of the species possessing hooks of approximately the same size it is necessary to note that their shape is of great diagnostic value

(1) *Hymenolepis diminuta* (Rudolphi, 1819) (Figs 287 & 288)

- Synonyms — *Tænia leptoccephala* Lussana & Romaro, no date
Tænia diminuta Rudolphi, 1819
Tænia leptoccephala Creplin, 1825
Tænia flavopunctata Weinland, 1858
Lepidotrias flavopunctata Weinland, 1858
Hymenolepis flavopunctata Weinland, 1858
Tænia flavomaculata Leuckart, 1863
Tænia varesina Parona, 1884
Tænia minima Grassi, 1886
Tænia reicta Zschokke, 1887
? *Hymenolepis reicta* Zschokke, 1887
Cysticercus hymenolepis-diminuta Railliet, 1892
Cysticercus tæniæ-diminuta (Rudolphi, 1819) Dolley, 1894
Tænia megaloon Linstow, 1901
Hymenolepis crassa Janicki, 1904
Hymenolepis sp, Janicki, 1904
Hymenolepis diminutoides Cholodkovsky, 1912

From rats, Rangoon Meggitt

The worm attains a length of from 20 to 60 cm and a breadth of from 2.5 to 4 mm. It is composed of from 600 to 1000 segments, all of which are broader than long. The genital pores are situated at the anterior third of the lateral margin of the segment. The scolex varies in diameter from 250 to 500 μ , a rostellum is present, but it is unarmed. The three testes are normally in the same straight line, the single poral testis being separated from the two aporal ones by the ovary, but they are extremely variable in arrangement. The egg measures from 54 to 86 μ in diameter. The larval stages occur in the meal-moth (*Asopia farinalis*), an earwig (*Anisotaxis annulipes*), beetles such as *Akis spinosa*, *Scaurus striatus*, and the meal-worm beetle (*Tenebrio molitor*), rat-fleas (*Ceratophyllus fasciatus*, *Xenopsylla cheopis*), a species of myriopods, and in Japan in various insects such as the tabby-moth

(*Aglossa dimidiata*), beetle (*Tribolium ferrugineum*), pyralid moth (*Paralipsa gularis*), and flour-moth (*Tinea granella*),

Fig 287

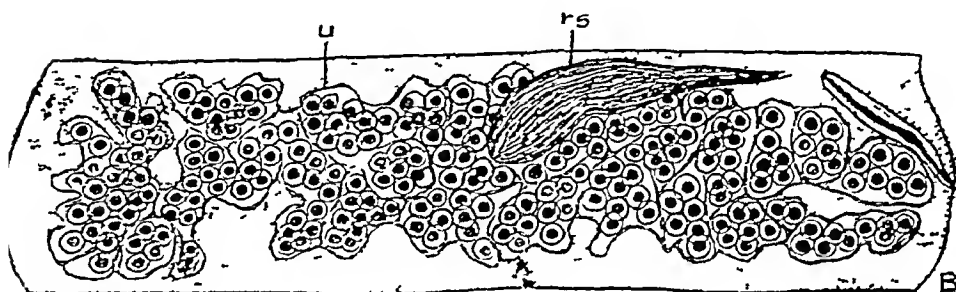
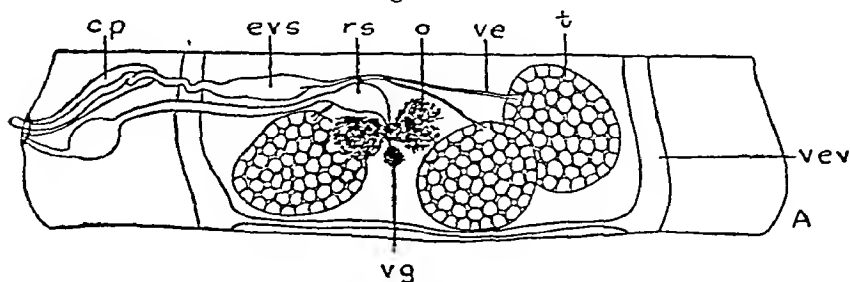


Fig 288

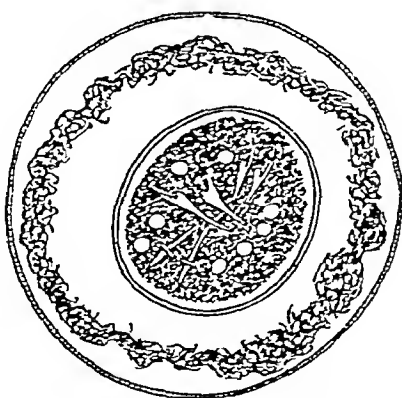
*Hymenolepis diminuta*

Fig 287—A, mature segment, $\times 54$, B, gravid segment, $\times 53$ (Original)
Fig 288—Egg, $\times 770$ (Original)

Meggitt (Burma) records *H. sciurina* Cholodkovsky, 1912, from *Sciurus erythraeus* Pallas, 1788, probably his species was *H. diminuta* Rudolphi, 1819. Meggitt's worms had a length

of 50 mm and a breadth of 2 mm. The scolex had a diameter of $250\ \mu$, and rostellar hooks were absent. The three testes were all in the same straight line, the cirrus sac measured 270 to $300\ \mu$ by $250\ \mu$ in gravid segments, and it extended almost to the excretory vessels. The ovary was situated between the most poral testis and the next. In the apparent absence of hooks Meggitt was uncertain whether this worm was Cholodkovsky's species (obtained from *Sciurus vulgaris*) or whether it was a specimen of *H. diminuta* (Rud., 1819).

Cholodkovsky's species attains a length of from 5 to 10 cm and a maximum breadth of 1.5 mm. The three testes in his specimens were situated, not in a straight line, but one porally and two aporally. The uterus was a complicated sac, and the egg measured about 40 by $20\ \mu$. No mention is made by Cholodkovsky of hooks on the head, but the position of the testes in Meggitt's specimens indicates that probably his species is not identical with *H. sciurina*. As a result we must accept Meggitt's suggestion that his worm was probably *H. diminuta* (Rudolphi, 1819).

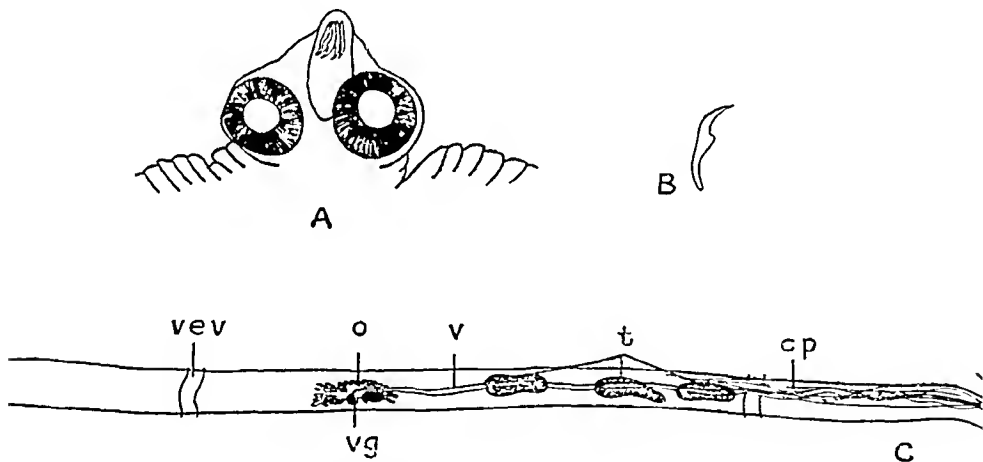


Fig 289 — *Hymenolepis lanceolata*. A head, $\times 150$, B, rostellar hook, $\times 334$, C, mature segment, $\times 20$ (Original)

(2) *Hymenolepis lanceolata* (Bloch, 1782) Weinland, 1858 (Fig 289)

Synonyms — *Fænia lanceolata* Bloch 1782

Dicranidota lanceolata (Bloch, 1782) Railliet, 1893

From the black Australian swan (*Chenopsis atrata*), Berhampur, Bengal Southwell

This species is extremely variable. The largest specimens attain a length of about 13 cm and a maximum breadth of

1.8 cm Fully gravid segments are frequently found in the small specimens, which are only 1.1 cm in length and $300\ \mu$ in breadth. In some worms either the male or female organs may be completely absent, and other abnormalities occur. All the segments are broader than long, and the unilateral genital pores are situated near the anterior corner of the lateral margin of the segment. The head is extremely small and globular, it bears a rather long cylindrical rostellum slightly swollen at its apex, and is armed with a single row of 8 hooks, each having a length of from 30 to $35\ \mu$.

The three testes are in line, in the posterior part of the segment and on the pore side of the ovary. The cirrus sac is very small and the cirrus is armed.

The ovary is situated on the aporal third of the segment. The egg is oval and measures about 50 by $35\ \mu$.

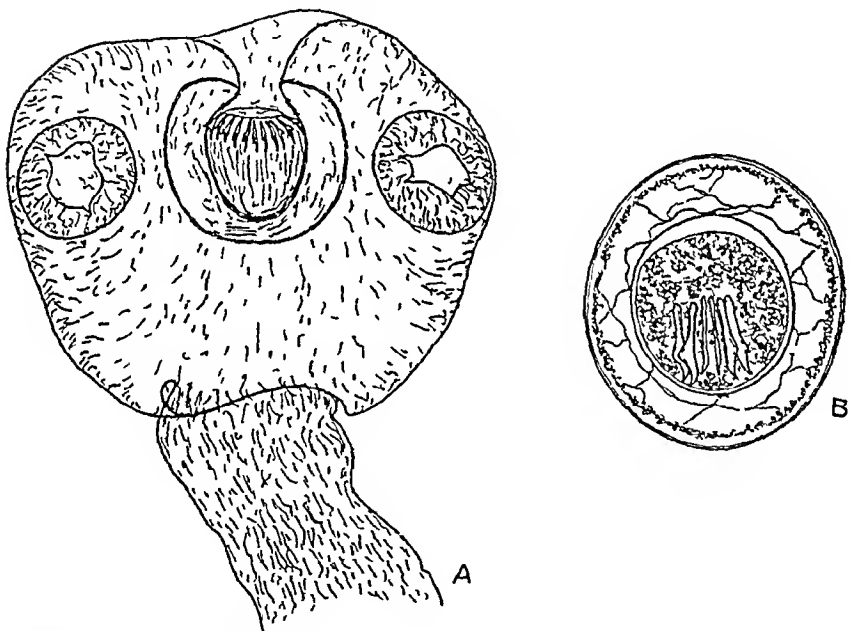


Fig 290 —*Hymenolepis murina* A, head, $\times 212$, B, egg, $\times 760$ (Original)

(3) *Hymenolepis murina* (Dujardin, 1845) R Blanchard, 1891
(Fig 290)

Synonyms — *Tania murina* Dujardin, 1845

Tænia nana Siebold, 1852

Diploacanthus nanus (Siebold, 1852) Weinland, 1858

Lepidotriasis murina (Dujardin, 1845) Weinland, 1858

Tænia ægyptica Bilharz, 1852

Hymenolepis nana (Siebold, 1852) R Blanchard, 1891

Hymenolepis nana var *fiatensis* Stiles, 1906

Hymenolepis inexpectata Cholodkovsky, 1912

Hymenolepis longior Baylis, 1922

From rats, Lahore Southwell Rangoon Meggitt A
frequent parasite of man throughout India

It will be noted that the species *H murina* found in the rat

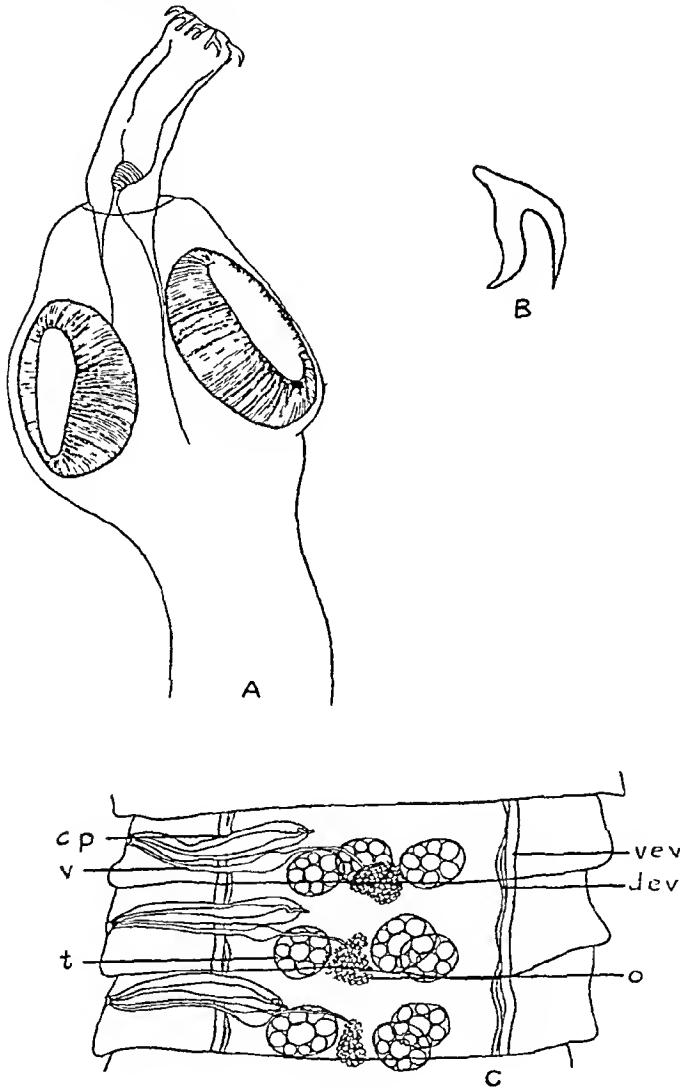


Fig 291 —*Hymenolepis fusa* A, head, $\times 225$, B, rostellar hook, $\times 1000$,
C, mature segments, showing irregular disposition of testes,
 $\times 100$ (Original)

is here considered identical with the species *H nana* found in
man Apparently the name *murina* has priority

The worm attains a length of from 7 mm to 8 cm (sometimes

even 14 cm) and a breadth of from 500 to 900 μ . It is composed of about 200 segments. The scolex is almost globular, and measures from 210 to 480 μ in length. The rostellum bears a single crown of from 24 to 28 hooks, each measuring 14 to 18 μ in length. The neck is moderately long, the genital pores are situated in the anterior half of the lateral margin of the segment. The three testes are in the same straight line, but are subject to considerable variation in position. The cirrus sac is small and does not extend to the excretory vessels. The egg measures from 30 to 60 μ in diameter and the oncosphere from 16 to 19 μ . The adult occurs in rodents and man, and the life-history is direct, *i.e.*, when the eggs are swallowed by the final host, cysticercoids develop in the intestinal villi and later on drop into the lumen of the gut, to which they attach themselves.

(4) *Hymenolepis fusa* (Krabbe, 1869), Fuhrmann 1906 (Fig 291)

Synonym — *Tenia fusa* Krabbe, 1869

From *Larus brunneicephalus*, Zoological Gardens, Calcutta Southwell

The worm attains a length of about 9 cm and a maximum breadth of 1 mm. All the segments are extremely short and their lateral margins are strongly salient. The genital pores are situated at the extreme anterior corner of the segment. The head is globular, having a diameter of 210 μ . The rostellum has a length of 105 μ and a breadth of 34 μ , it is armed with 10 hooks, each 16 μ in length and of the shape figured by Krabbe for this species.

The three testes are disposed irregularly, thus in some segments there are two aporal testes, in other segments two poral testes, whilst in still others one testis lies between, and anterior to, the other two. The cirrus sac is a conspicuous structure extending in a straight line almost to the middle of the segment. The uterus is a simple sac full of eggs.

(5) *Hymenolepis spinosa* Lanstow, 1906 (Fig 292)

From the painted snipe (*Rostratula capensis*), Vavuniya, Ceylon ? Willey

The worm attains a length of about 1.5 cm and a maximum breadth of 620 μ . All the segments are broader than long. The genital pores are unilateral and are situated at the junction of the first and second quarters of the lateral margin of the segment. The rostellum is armed with ten hooks, each measuring 28 μ . The cortex is well developed, limited internally by a layer of transverse muscles, there are numerous

small groups of longitudinal muscle bundles and, in addition, eight strong bundles of longitudinal fibres. The ventral excretory vessel is much larger than the dorsal. Of the three large testes, one is anterior, close to the cirrus sac, and the other two side by side further back. The cirrus is large and occupies almost one-third of the transverse diameter.



Fig 292 — *Hymenolepis spinosa* Rostellar hook, magnification unknown (After Linstow)

The ovary is median, and behind it lies the vitelline gland, which occupies a quarter of the transverse diameter of the segment. The shell gland is ovate and is situated centrally between the second and third testes. The coiled vagina is situated a little on the poral side of the middle line. The genital ducts pass between the excretory ducts. The egg measures about $47\ \mu$ and the oncosphere 26 by $18\ \mu$.

(6) *Hymenolepis septaria* Linstow, 1906

From *Upupa ceylonensis*, Weligatta, Ceylon ? Willey

The worm attains a length of 2.5 cm and a maximum breadth of $790\ \mu$. The last segments are longer than broad. The scolex is truncated anteriorly and measures $130\ \mu$ in length and $220\ \mu$ in breadth. The rostellum is small and knob-shaped, hooks absent, probably lost. There is no neck. The dorsal excretory vessel on each side is larger than the ventral. The longitudinal muscles are in circular bundles just beneath the thick cuticle, calcareous corpuscles absent.

The three testes are oval, all in a row, and situated dorsally in the middle of the segment. The cirrus sac has its internal extremity directed obliquely ventrally. The ovary is strongly developed and occupies the whole length of the segment, it gives off ventrally a broad transverse branch from which, to the right and left, two broad cornua extend in the form of a horse-shoe towards the dorsal side, leaving room for the testes, the vitelline gland, and the shell gland. The vitelline gland is in the middle line, ventral to the testes, and the shell gland is still more ventral in position. The uterus completely fills the gravid segments, and is subdivided by dorso-ventral septa. The egg measures 73 by $64\ \mu$.

(7) *Hymenolepis clausa* Linstow, 1906 (Fig 293)

From the whistling teal (*Dendrocygna javanica*), Tissamaharama, Ceylon ? Willey

The worm measures 1.8 cm in length and has a maximum breadth of 1.5 mm. There is no neck. According to Linstow, genital pores are absent and the dorsal cirrus sac and the ventral vagina merge into one another, directly a little distance from the posterior margin of the segment. The scolex measures about $100\ \mu$ in length by $230\ \mu$ in breadth. The rostellum is globular and is armed with 8 hooks, each measuring $57\ \mu$ in length.

The longitudinal muscles are in two layers of bundles, the outer ones small and numerous, and the inner large and few.



Fig 293 — *Hymenolepis clausa* Rostellar hook, magnification unknown (After Linstow)

The three testes are dorsal and posterior, the central one being a little behind the other two. The cirrus sac is very large, extending three-fifths the distance across the segment. The cirrus is long and coiled. The orifice of the cirrus sac, where it passes into the vagina, is closely beset with small spinules. The racemose ovary is asymmetrical, ventral to the vagina, and transversely elongated, immediately in front of it is the rounded shell gland; eggs unknown.

(8) *Hymenolepis rugosa* Clerc, 1906, var *birmanica* Meggitt, 1924 (Fig 294)

From pigeons (*Columba* sp.), Rangoon Meggitt

The worm attains a length of 7 cm and a breadth of $600\ \mu$. The scolex has a diameter of $200\ \mu$ and bears four unarmed suckers. The rostellum is armed with 8 hooks, each measuring from 88 to $95\ \mu$ in length. These hooks differ from those of *H. rugosa* in size and in having the proximal end slightly bent. The hooks extend posterior to the suckers. The genital pores are situated in the extreme anterior angle of the margin of the proglottis. The genital atrium is very small.

Musculature The longitudinal muscle-bundles are well developed, internal to them is a delicate layer of transverse muscles, internal to the circular muscles is a second layer

of longitudinal muscles consisting of 8 muscle-strands, and arranged two between the excretory vessels and two internal to them on each surface of the worm. A second delicate sheet of transverse muscles separates the cortex from the medulla.

Male Genitalia The testes are dorsal, and they usually lie in a straight line, but of the two aporal testes one may be anterior or ventral to the other. The cirrus sac extends beyond the aporal excretory vessels, and in some cases almost to the aporal margin of the proglottis. The cirrus is armed. The internal vesicula seminalis occupies about half the cirrus sac whilst the external vesicula seminalis extends from the aporal excretory vessel a third the length of the cirrus.



Fig 294—*Hymenolepis rugosa* var *humanica* Rostellar hook, $\times 267$
(After Meggitt, in 'Parasitology')

Female Genitalia The ovary is somewhat lobed and, when fully developed, touches the excretory vessel on each side. The receptaculum seminis extends from the aporal excretory vessel to the centre of the proglottis. Uterus not described.

(9) *Hymenolepis kemp*i (Southwell, 1921) Mayhew, 1925 (Fig 295)

Synonym —*Dilepis kemp*i Southwell, 1921

From the little cormorant (*Phalacrocorax niger*), North Loktak Lake, Manipur, Assam 14.2.20 Station 1 Manipur Survey, Zoological Survey of India.

Southwell placed this species in the genus *Dilepis* on account of the fact that the head bears a double row of hooks. Mayhew referred it to the genus *Hymenolepis* because of the presence of three testes, even though in his description of the genus he states that the rostellum is "armed with a single crown of hooks or it may be unarmed". It is clear that the species cannot definitely be placed in Mayhew's genus *Hymenolepis* as defined by him. The characters of the worm are those of the genus *Dilepis*, except that there are three testes only.

The largest worm measures 5 cm. in length and the greatest breadth is about 1 mm. It contains over 500 segments, all

of which are broader than long, the posterior segments measure about $400\ \mu$ in length and $900\ \mu$ in breadth. The genital pores are unilateral and are situated in the anterior half of the segment. The head is about $220\ \mu$ in length and $400\ \mu$ in breadth. The rostellum measures about $170\ \mu$ in length and $160\ \mu$ in breadth, it is armed with 20 hooks arranged in a double row. The hooks in the posterior row curve backwards strongly and measure about $135\ \mu$, whilst those in the

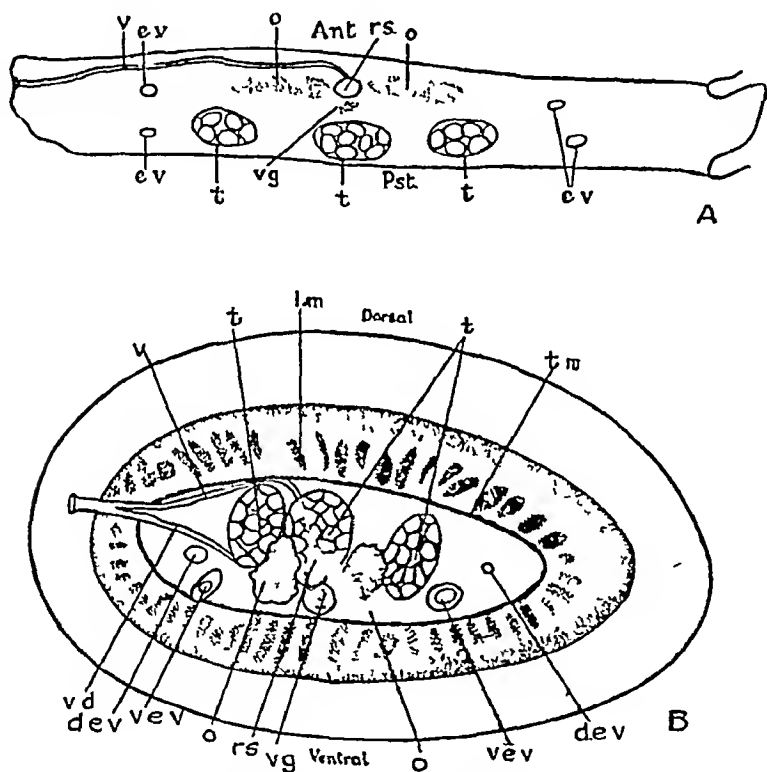


Fig 295 —*Hymenolepis lempri* A, horizontal section of mature segment, $\times 105$, B, transverse section of mature segment, $\times 75$ (After Southwell)

anterior row are not so strongly curved, and measure about $175\ \mu$. The diameter of the suckers is about $100\ \mu$. There is no neck.

Male Genitalia There are three testes situated posteriorly, all in one line, two being aporal. They measure about $140\ \mu$ by $70\ \mu$, their long diameter being dorso-ventral. The vas deferens arises somewhat ventrally and, curving dorsally to the vagina, runs to the pore. The cirrus sac is small and insignificant.

Female Genitalia The ovary is situated in the median anterior field. It consists of two irregularly-shaped wings, each measuring about $160\ \mu$ in breadth. The vagina is conspicuous, running dorsally to the vas deferens and excretory vessel. It opens in front of the vas deferens, close to the ovary; it dilates into a receptaculum seminis. The vitelline gland measures about 70 by $50\ \mu$ and lies posteriorly between the two wings of the ovary. The uterus is a large sac-like organ with very large and numerous diverticula, extending laterally to the excretory vessels on both sides, ripe eggs unknown.

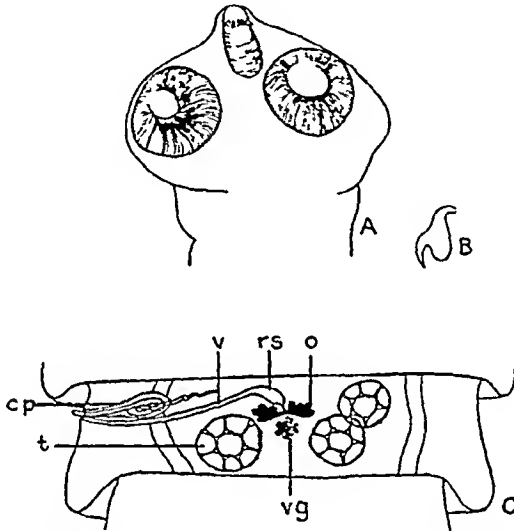


Fig 296 — *Hymenolepis farcimiosa* A, head, $\times 90$, B, rostellar hook, $\times 400$, C, mature segment, $\times 53$ (Original)

(10) *Hymenolepis farcimiosa* (Goeze, 1782) (Fig 296)

Synonyms — *Tenia farcimiosa* Goeze, 1782

Tenia farciminalis Batsch, 1786

Tenia acridotherides Parona, 1890

Hymenolepis farciminalis (Batsch, 1786) R Blanchard, 1891

Diplacanthus farciminalis (Batsch, 1786) Volz, 1899

Weinlandia farcimiosa (Goeze, 1782) Mayhew, 1925

Hymenolepis dahurica of Southwell, 1922

From (1) *Corvus macrorhynchus*, Zoological Gardens, Calcutta Southwell (2) *Acridotheres tristis* and (3) *A. albocinctus*, Rangoon Meggitt

The worm attains a length of 72 cm and a breadth of 1 mm . The genital pores are situated in the centre of the margin of the proglottis in old segments, but in young segments they are slightly anterior to the middle. The scolex has a diameter of

265 μ The rostellum has a diameter of 100 μ and extends as far as the posterior margins of the suckers, it is armed with 10 hooks which, according to Krabbe, measure 23 μ , but Meggitt states that they are from 18 to 21 μ

Male Genitalia Of the two aporal testes, one is usually anterior and a little external to the other. The cirrus sac varies greatly in size in different parts of the strobila. Volz gives the length as 120 μ , and Meggitt states that it measures from 180 to 300 μ , it reaches slightly median to the excretory vessels. The external vesicula seminalis does not extend beyond the centre of the proglottis.

Female Genitalia The ovary is especially deeply bilobed, each part being almost spherical, and attached only by a narrow isthmus. The uterus is partly septate.

(11) *Hymenolepis gracilis* (Zeder, 1803) Cohn, 1901 (Fig 297)

Synonyms — *Tenia gracilis* Zeder, 1803

Dicpanidotenia gracilis (Zeder, 1803) Railliet, 1893

Weinlandia gracilis (Zeder, 1803) Mayhew, 1925

From (1) *Crocopus phaeucopterus*, Chilka Lake, Orissa, India. Southwell. (2) The tufted duck (*Nyroca fuligula*), Loktak Lake, Manipur, Assam. Southwell. (3) *Phaeucopterus roseus*, Zoological Gardens, Calcutta. Southwell. (4) Domestic ducks, Rangoon. Meggitt.

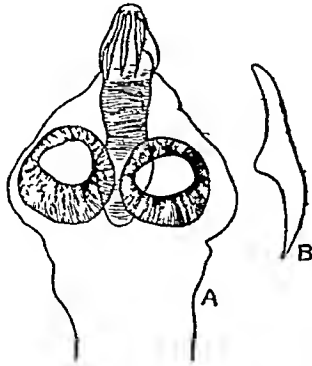


Fig 297 — *Hymenolepis gracilis* A, head, $\times 90$, B, rostellar hook, $\times 240$ (Original)

The worm measures from 12 to 27 cm in length and has a maximum breadth of about 2 mm. The rostellum has a length of about 100 μ and a breadth of 40 μ . It is armed with 8 rather simple hooks, each having a length of from 76 to 82 μ . The segments are, as is usual in this genus, broader than long, the posterior ones may be square. The genital pores are

situated in the anterior quarter of the margin of the proglottis, and are frequently hidden by the overlap of the preceding segment. The longitudinal muscles are in 8 bundles.

Of the three testes, two are aporal, and of these two one is invariably external and anterior to the other. The cirrus sac extends nearly to the aporal longitudinal excretory vessel, there is a large and conspicuous external vesicula seminalis. The sacculus is also prominent.

The ovary is somewhat bilobed and is situated close to the aporal and the internal aporal testes. The vitelline gland lies posteriorly between the two wings of the ovary. The vagina is prominent and sinuous, with a conspicuous receptaculum seminis.

Larval forms of this worm have been recorded in Europe from various Ostracods, such as *Cypris compressa*, *C. cinerea*, *C. ophthalmica*, *Cyclops viridis*, *Candona rostrata*, and *Diaptomus* sp.

(12) *Hymenolepis spheonocephala* (Rudolphi, 1809) Fuhrmann, 1906

SYNONYMS — *Hymenolepis columbae* (Zeder, 1820)

Wenlandia spheonocephala (Rudolphi, 1809) Mayhew, 1925

From pigeons (*Columba* sp.), Rangoon. Meggitt

The worm measures about 6 cm. in length and has a maximum breadth of about 2 mm. The genital pores are situated in the anterior corner of the segment. The head is armed with 8 hooks of a peculiar shape, which measure $72\ \mu$ in length. There is a well-developed neck.

The musculature consists of an inner transverse layer, and of an outer longitudinal layer of four bundles.

Of the three testes two are aporal, one being anterior and external to the posterior testis. The cirrus sac is very long, extending three-quarters the distance across the proglottis, its internal extremity lies close to the anterior margin of the proglottis. There is a very prominent sacculus accessorius. The cirrus is frequently found evaginated, the free part sometimes measures up to $200\ \mu$, its terminal portion is chitimized.

The vagina consists of two parts, first a muscular with a very wide lumen, which runs dorsally from the genital cloaca as far as the inner limit of the sacculus accessorius, where it opens into the second section, which is a very muscular duct with no apparent lumen. This is spirally coiled, and, running ventrally and anteriorly, it opens into an enormous receptaculum seminis. The egg has a diameter of about $36\ \mu$ and the oncosphere measures $24\ \mu$.

(13) *Hymenolepis coronula* (Dujardin, 1845) Cohn, 1901Synonyms — *Tænia coronula* Dujardin, 1845*Dicranotænia coronula* (Dujardin, 1845) Railliet, 1892*Hymenolepis megallysteræ* Lanstow, 1905*Weinlandia coronula* (Dujardin, 1845) Mayhew, 1925

From domestic ducks, Rangoon McGgitt

The worm measures from 12 to 19 cm in length and has a maximum breadth of 3 mm. The scolex measures about 2 mm in length. The rostellum has a length of about 60 μ and is armed with about 20 peculiar hooks, each having a length of from 12.8 to 17.6 μ . The segments are very short.

Of the three testes one is poral and two aporal. The position of the latter varies according to the state of contraction of the segment, when this is strongly contracted, the three testes are in the same straight line, but in a relaxed condition one aporal testis is anterior and internal to the others. The cirrus sac extends to the ventral longitudinal excretory vessel, the internal vesicula seminalis occupies two-thirds of the sac. The sacculus accessorius is small, uniform in diameter, and straight. The external vesicula seminalis is a small spindle-shaped dilatation situated dorsally and laterally to the receptaculum seminis.

The ovary is a rather elongated organ placed posteriorly and occupying one-third the breadth of the proglottis. The vitelline gland lies posteriorly and ventrally to the ovary. The receptaculum seminis is very large, extending from the ventral longitudinal excretory vessel halfway across the proglottis. The uterus at first is a narrow sac twisted upon itself, as a result of which its cavity appears to be divided up into a series of separate compartments. When fully developed it occupies all the proglottis, extending beyond the excretory vessels. Mature eggs have apparently not been found. Larval forms of this species have been recorded in Europe from several species of Ostracods, viz., *Cypris compressa*, *C. ovum*, *C. ophthalmica*, *C. cinerea*, and *Candana candida*.

(14) *Hymenolepis liguloides* (Gervais, 1847) (Fig. 298)Synonyms — *Halysis liguloides* Gervais, 1847*Tænia liguloides* (Gervais, 1847) Diesing, 1850*Tænia caroli* Paroni, 1887*Dipendotænia liguloides* (Gervais, 1847) Cohn, 1900*Hymenolepis caroli* (Pai, 1887) Parona, 1900*Weinlandia liguloides* (Gervais, 1847) Mayhew, 1925*Diorchis oclusa* Lanstow, 1906*Anabilia lamelhyæa* Lanstow, 1879

From the flamingo (*Phœnicopterus roseus*), Weligatta, Ceylon ? Willey, and the Zoological Gardens, Calcutta Southwell

The worm attains a length of 7.5 cm and a breadth of about 1 mm, the body is ovate in cross-section. All the segments are broader than long. Linstow stated that genital pores were absent, but they are present and are unilateral, situated at the extreme anterior corner of the lateral margin of the segment. The scolex is somewhat triangular in shape and has a diameter of about $530\ \mu$. It is armed with 8 hooks, each having a length of from 110 to $130\ \mu$. The ventral

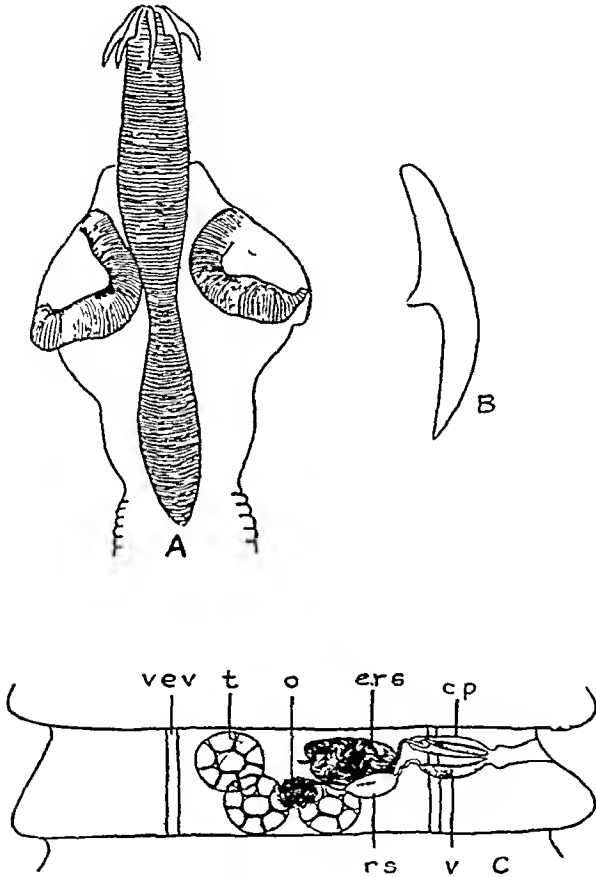


Fig 298 — *Hymenolepis liguloides* A, head, $\times 60$, B, rostellar hook, $\times 270$, C, mature segment, $\times 100$ (Original)

excretory vessel is much larger than the dorsal. The longitudinal muscles are well developed, and consist of a series of rather small, closely set bundles. Of the three testes, one is poral and the other two aporal. The cirrus sac extends

beyond the ventral excretory vessel to the aporal testis, it contains an internal vesicula seminalis, the external vesicula seminalis is conspicuous and extends to the level of the vitelline gland. The cirrus sac lies dorsally to the vagina, and both genital ducts are situated dorsally to the excretory vessels. The ovary is slightly aporal and lies ventrally to the vitelline gland, the latter organ is median and presents a somewhat follicular appearance. The vagina terminates at the pore in a conspicuous sacculus accessorius. Internally there is a large receptaculum seminis situated dorsally to the ovary. The size of the egg is not known.

(15) *Hymenolepis furcata* (Stieda, 1862) (Fig 299)

Synonyms — *Tenia furcata* Stieda, 1862

Weinlandia furcata (Stieda, 1862) Mayhew, 1925

Lepidothraus furcata (Stieda) Cohn, 1899

From *Crocidura murina*, Rangoon Meggitt

The worm attains a length of 1.5 cm and a breadth of $250\ \mu$. The genital pores are situated in the centre of the margin of the segment. The scolex has a diameter of $125\ \mu$ and the rostellum of $70\ \mu$. The latter extends to, or beyond, the posterior margins of the suckers and bears 25 hooks, each of which has a length of from 19 to $24\ \mu$.

Male Genitalia There are three testes, one being poral and two aporal, of the two latter the anterior testis lies internally to the posterior one. The cirrus sac measures from 44 to $56\ \mu$ by $17\ \mu$, and extends a quarter of the breadth of the segment.

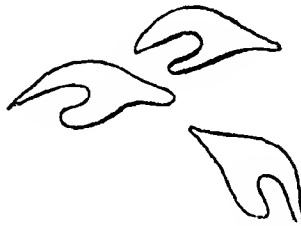


Fig 299 — *Hymenolepis furcata* Rostellar hooks, $\times 500$
(After Meggitt, in 'Parasitology')

Female Genitalia When fully mature the ovary occupies the entire breadth of the segment, near the genital pore the vagina dilates into a terminal swelling which communicates by means of a narrow portion with a large, central, globular receptaculum seminis. The uterus is rectangular and fills the whole segment, dorsally, but not ventrally, it is divided by a partition into two almost equal halves.

(16) *Hymenolepis medici* (Stossich, 1890) Fuhrmann, 1906.
(Fig 300)

Synonyms — *Tenia medici* Stossich, 1890

Wernandia medici (Stossich, 1890) Mayhew, 1925

From *Pelicanus philippensis*, Zoological Gardens, Calcutta
Southwell

The worm has a length of about 1.5 cm and a breadth of $500\ \mu$, all the segments are broader than long except the posterior ones, which are square. The latter measure $500\ \mu$. The unilateral pores are situated near the middle of the segment. The head has a length of about $200\ \mu$ and a breadth of $340\ \mu$.

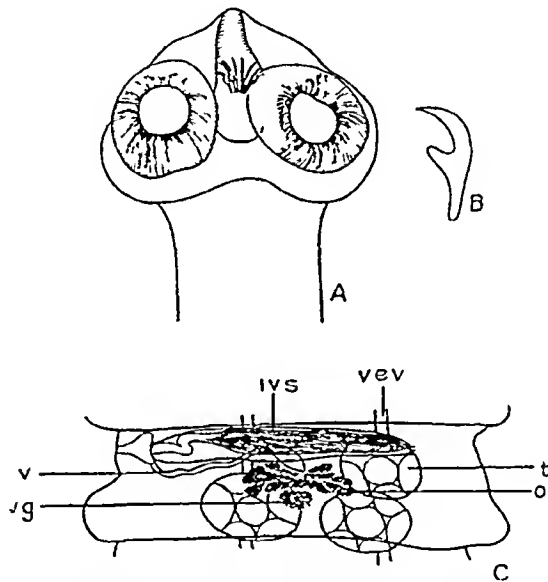


Fig 300 — *Hymenolepis medici* A, head, $\times 90$, B rostellar hook, $\times 400$, C, mature segment, $\times 127$ (Original)

The rostellum is armed with 22 hooks, which measure from 30 to $34\ \mu$. Fuhrmann stated that he was unable to discover a ventral aporal excretory vessel, but this was present in the Indian specimens, on each side the ventral vessel is much larger than the dorsal.

Of the three testes, two are situated aporally, one in front of the other, the cirrus sac is very prominent and has a length of $180\ \mu$, it extends more than halfway across the segment. Together with the vagina it opens into a conspicuous genital atrium. Fuhrmann stated that in his specimen the cirrus sac extended to the anterior aporal corner, and even into the preceding segment. This condition only occurs in the gravid

segment of Indian specimens. Within the sac the vas deferens is coiled, a small internal and a large external vesicula seminalis are present, the latter being situated dorsally to the cirrus sac. Up to the present the female genital organs have not been described.

The ovary is a somewhat bilobed organ situated in the middle of the segment, posterior to the internal third of the cirrus sac, it has a breadth of 80μ . Immediately posterior to it is an oval vitelline gland having a length of about 40μ . The vagina opens posteriorly to the cirrus sac, its terminal part being dilated. The uterus develops as a curved, transverse, lobulated sac eventually filling the entire segment.

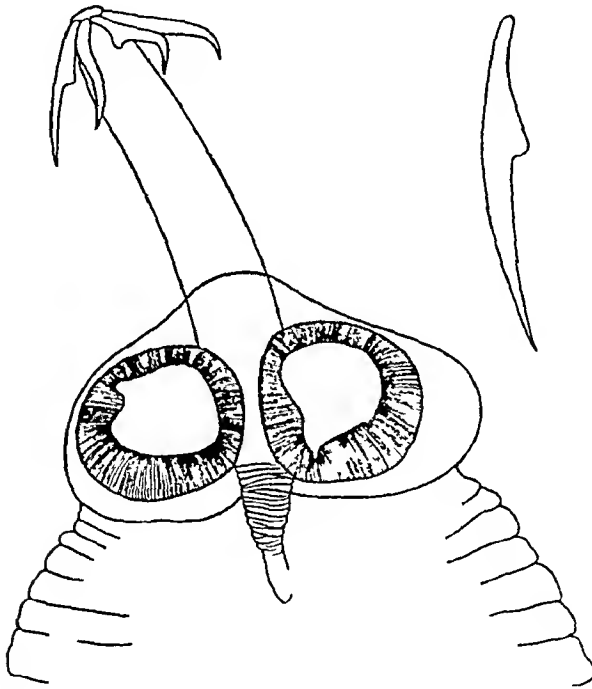


Fig 301 — *Hymenolepis megalorchis* Head, $\times 225$, rostellar hook, $\times 500$ (Original)

(17) *Hymenolepis megalorchis* (Luehe, 1898) (Fig 301)

Synonyms — *Tænia megalorchis* Luehe, 1898

Dipandotænia megalorchis (Luehe, 1898) Cohn, 1900

Weinlandia megalorchis (Luehe, 1898) Mayhew, 1925

From the flamingo (*Phænicopterus roseus*), Zoological Gardens, Calcutta. Southwell

The worm attains a length of about 8 mm and a breadth of about 800μ , it is composed of from about 35 to 50 segments, all of which are broader than long. The genital pores are

situated a little in front of the centre of the lateral margin of the segment. The head has a diameter of about $200\ \mu$, the rostellum has a length of $120\ \mu$ and a breadth of $45\ \mu$. It is armed with 8 hooks, each having a length of about $90\ \mu$.

Of the three testes, two are situated aporally, the cirrus sac is extremely long and extends across the anterior part of the segment almost to the aporal excretory vessel.

The ovary and the vitelline gland lie between the two posterior testes and on the poral side of the aporal testis. The uterus is a large simple sac filling the segment.

(18) *Hymenolepis simplex* Fuhrmann, 1906 (Fig 302)

Synonym — *Weinlandia simplex* (Fuhrmann, 1906) Mayhew, 1925

From *Tadorna cornuta*, Zoological Gardens, Calcutta. Southwell

The worm measures about 5 cm in length and $800\ \mu$ in breadth. All the segments are broader than long. The head is armed with 20 hooks, each of which measures $12\ \mu$.

Of the three testes, two are aporal, one being in front of the other, they are very large and, when fully developed, have a



Fig 302 — *Hymenolepis simplex* Rostellar hook, magnification unknown (After Lube)

diameter of $150\ \mu$. The cirrus sac is voluminous, extending to the aporal excretory vessel, it contains a very large vesicula seminalis. The sacculus accessorius has a diameter of $120\ \mu$ and is covered with minute spines.

The ovary is bilobed and has a diameter of $80\ \mu$. Posteriorly to it is a compact vitelline gland having a diameter of $80\ \mu$. The uterus is saccular and entirely fills the segment.

(19) *Hymenolepis zosteropsis* Fuhrmann, 1918. (Fig 303)

Synonyms — *Hymenolepis stylusa* of Southwell, 1922

Weinlandia zosteropsis (Fuhrmann, 1918) Mayhew, 1925

From the following hosts, all obtained from the Zoological Gardens, Calcutta. Southwell —

(1) The white-cheeked bulbul (*Crimiger flaveolus*), (2) the green magpie (*Cissa chinensis*), (3) the eastern baya (*Ploceus passerinus*), (4) the crested bunting (*Melophus melanacterus*), (5) the tree-pie (*Dendrocitta* sp.), (6) the golden-backed woodpecker (*Brachypternus aurantius*), (7) the laughing-thrush

(*Trochalopteron meridionale*), (8) the magpie (*Pica rustica*) and (9) *Ploceus atrigula*

The worm attains a length of about 2.2 cm and a breadth of $700\ \mu$. The posterior segments are somewhat bell-shaped and have a length of about $170\ \mu$ and a breadth of $700\ \mu$. The unilateral genital pores are situated in the anterior third of the lateral margin of the segment. The scolex has a breadth of about $200\ \mu$, the rostellar pouch extends to the posterior margin of the suckers. The rostellum is armed with 10 peculiarly shaped hooks arranged in a single row. In worms from *Ploceus atrigula* they measured about $36\ \mu$ in length,

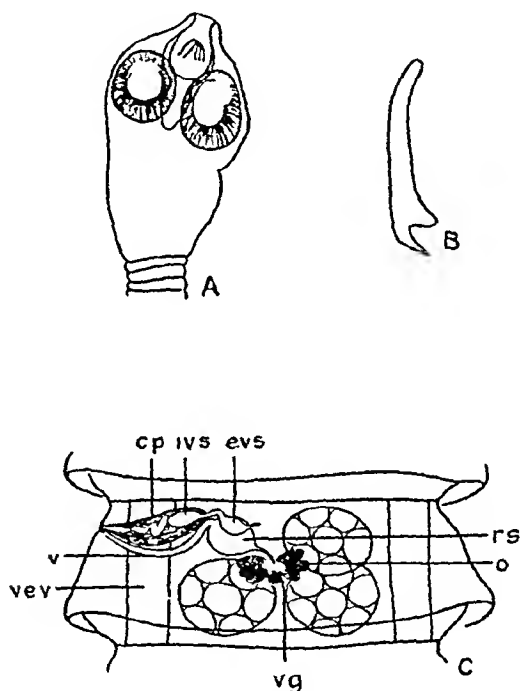


Fig 303 —*Hymenolepis zosteropsis* A, head, $\times 64$, B, rostellar hook, $\times 594$, C, mature segment, $\times 64$ (Original)

whilst in specimens from the other hosts they measured about $30\ \mu$

The longitudinal muscles consist of two layers of bundles, the internal one being more strongly developed than the outer, they are disposed in 12 bundles dorsally and 12 bundles ventrally. The genital organs appear in segments about 6 mm behind the head.

Of the three testes, two are situated aporally, one in front of the other. The cirrus sac extends in the median direction beyond the excretory vessel, it is club-shaped and measures

from 120 to 140 μ . There is a conspicuous external seminal vesicle which has a length of 60 μ .

The ovary is slightly bilobed and has a breadth of about 160 μ . The vagina opens ventral to the cirrus sac, in the median direction it dilates into a receptaculum seminis which has a length of 70 μ . Immediately behind the ovary there is an oval vitelline gland having a diameter of 60 μ . The gravid uterus is a lobed sac entirely filling the segment. The egg is relatively large and measures about 60 μ in diameter, the oncosphere has a diameter of about 23 μ . Each uterus contains about 60 eggs.

(20) *Hymenolepis annandalei* Southwell, 1922. (Figs 304 & 305)

Synonym — *Weinlandia annandalei* (Southwell, 1922) Mayhew, 1925

From the black-tailed godwit (*Limosa belgica*), Barkuda, Chilka Lake, Orissa, India. Annandale

The worm attains a length of 10.3 cm and a breadth of 2 mm. Its anterior part is attenuated and whip-like, all the segments are broader than long, the posterior and lateral margins being salient. The genital pores are unilateral and are situated slightly anterior to the middle of the lateral margin. The head measures about 180 μ in length and has a breadth of 150 μ , the suckers have a diameter of about 80 μ . The rostellum is a conspicuous organ armed with a single row of 10 hooks, each of which measures about 32 μ in length, both in size and shape they closely resemble those of *H. brasiliense* Fuhrmann, 1906. The neck measures about 2 mm in length.

The muscular system is feebly developed. The longitudinal muscles consist of an inner and an outer series of bundles, the former being situated immediately beneath the cuticle. A few circular fibres occur between the outer and inner longitudinal bundles and also internally to the inner longitudinal fibres. No oblique fibres have been noticed.

Details of the nervous system are not known. A small ill-defined nerve can be seen in transverse sections running externally to the water vessel on each side.

The excretory system consists of a single ventral vessel on each side, lying ventrally to the cirrus sac and vagina.

There are three testes. One is situated on the pore side and the other two are aporal, one being anterior to the other. When fully mature they have a diameter of about 150 μ , and occupy almost the whole of the segment dorso-ventrally. The cirrus sac lies dorsally to the vagina, it is somewhat club-shaped, the broader extremity being median. It measures about 180 μ in length and its greatest breadth is about 40 μ . Its central part is occupied by an internal seminal vesicle. In the median direction it continues as a very short, wide, coiled tube, and then dilates into a large external seminal vesicle.

which measures about $160\ \mu$ in length and $30\ \mu$ in breadth, the median extremity of the external seminal vesicle is close to the poral testis

The ovary is situated in the middle line, it measures about $100\ \mu$ in the antero-posterior direction and has a breadth of $300\ \mu$, whilst dorso-ventrally it practically fills that part of the segment. The vagina is a very muscular club-shaped organ measuring about $450\ \mu$ in length. At the pore its breadth is about $10\ \mu$, it gradually widens, and attains

Fig 304

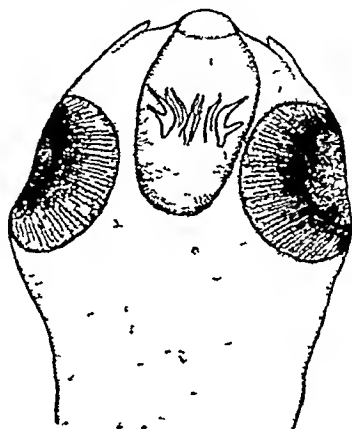


Fig 305

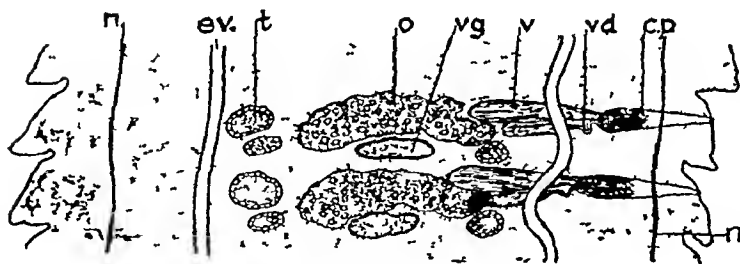
*Hymenolepis annandalei*

Fig 304 —Head, $\times 220$ (After Southwell)

Fig 305 —Horizontal section of mature segments, $\times 60$ (After Southwell)

a maximum diameter of $50\ \mu$ at a point opposite the middle of the external seminal vesicle, it then narrows gradually. The whole vagina functions as a receptaculum seminis. The vitelline gland is a conspicuous bilobed organ situated posteriorly to the centre of the ovary, it has a breadth of about $100\ \mu$. The uterus is a simple transverse sac extending well beyond the excretory vessel on each side, and almost to the edge of the segment. The largest egg measures about $17\ \mu$ in diameter and the oncosphere $11\ \mu$.

(21) *Hymenolepis rustica* (Meggitt, 1926)

Synonym — *Weinlandia rustica* Meggitt, 1926

From the domestic fowl, Burma Meggitt

The worm varies in length from 4 mm to 2.5 cm and attains a maximum breadth of 6 mm. The unilateral pores are situated at the centre of the margin of the segment, sometimes slightly dorsal. The rostellum is unarmed and extends posteriorly to the centre of the suckers.

Of the aporal testes, one lies in front of the other, the cirrus sac measures from 200 to 230 μ in length and reaches the aporal excretory vessel. The ovary almost touches the excretory vessel on each side. The uteri of the posterior proglottides are in communication with each other. This species resembles *H. carioca* (Magalhaes, 1898), but differs from it in having a larger cirrus sac and in the receptaculum seminis occupying a different position.

(22) *Hymenolepis ficticia* (Meggitt, 1927) (Fig. 306)

Synonym — *Weinlandia ficticia* Meggitt, 1927

From a pelican, Victoria Memorial Park, Rangoon Meggitt

The worm attains a length of from 1.5 to 2 cm and a breadth of 200 μ . The genital pores are situated at the anterior third or quarter of the lateral margin of the proglottides, a narrow genital atrium is present, but a sacculus accessorius is absent. The scolex has a diameter of from 170 to 200 μ , the rostellum has a diameter of from 60 to 70 μ and extends nearly to the



Fig. 306 — *Hymenolepis ficticia*. Rostellar hooks, $\times 585$
(After Meggitt, in 'Parasitology')

posterior margin of the suckers, it is armed with a double crown of hooks, 24 in all, the large hooks, which measure from 48 to 52 μ , alternating with the smaller hooks, which measure from 44 to 49 μ . Ventral excretory vessels are present together with a large plexus on the ventral surface of the proglottis.

Male Genitalia Of the three testes, all of which are close together and fill the dorsal surface of the segment, two are posterior, the third is anterior, and either internal or external to the aporal posterior testes, the cirrus sac measures from 140 to 160 μ by 28 to 44 μ in gravid segments, extending practically to the aporal excretory vessel, but not entering the preceding segment.

Female Genitalia The ovary is ventral to the testes, at first it is lobed, then horse-shoe-shaped. A large receptaculum seminis is present, filling two-thirds of the space, ventrally, between the excretory vessels. In the posterior segments there are found large granular bodies almost the size of the testes, some of which appear to be remains of either the degenerating receptaculum seminis or vesicula seminalis.

This species is very similar to *Weinlandia medica* (Stossich, 1890), but differs in having two sizes of hooks, an aporal excretory vessel, and a cirrus sac confined to one segment.

(23) *Hymenolepis minutissima* (Meggitt, 1927) (Fig 307)

Synonym — *Weinlandia minutissima* Meggitt, 1927

From *Crocodura murina*, Rangoon. Meggitt

The worm measures only 2 mm in length and attains a breadth of 150 μ . It should be noted, however, that gravid segments have not been obtained. The scolex has a diameter

Fig 307



Fig 308

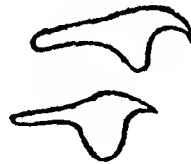


Fig 307 — *Hymenolepis minutissima* Rostellar hooks, $\times 500$ (After Meggitt, in 'Parasitology')

Fig 308 — *Hymenolepis solitaria* Rostellar hooks, $\times 500$ (After Meggitt, in 'Parasitology')

of from 120 to 125 μ , the rostellum has a diameter of 46 to 75 μ and extends beyond the posterior margins of the suckers, it is armed with 12 hooks, each of which has a length of from 16 to 18 μ . The cirrus sac extends inwardly beyond the excretory vessels.

(24) *Hymenolepis solitaria* (Meggitt, 1927) (Fig 308)

Synonym — *Weinlandia solitaria* Meggitt, 1927

From *Crocodura murina*, Rangoon. Meggitt.

This species only differs from *H. minutissima* in the fact that the rostellum is armed with 16 hooks, each of which measures 16 or 17 μ in length.

- (25) *Hymenolepis phalacrocorax* (Woodland, 1929) (Fig 309)
 Synonym — *Wemlandia phalacrocorax* Woodland, 1929

From the large cormorant (*Phalacrocorax carbo*), Chitrakot, United Provinces, India Woodland

The worm attains a length of about 12 cm and a maximum breadth of 1.5 mm. The scolex is unarmed and has a diameter of about 330μ . The genital pores are unilateral and are

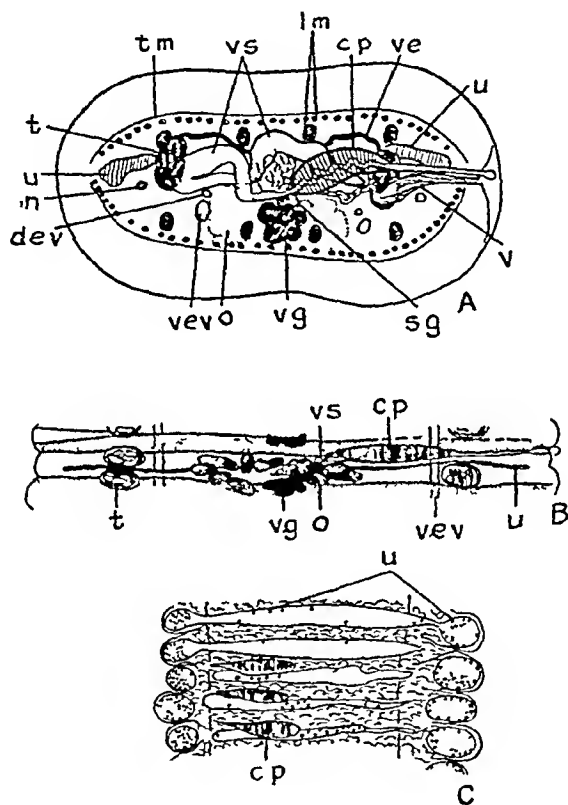


Fig 309 — *Hymenolepis phalacrocorax* A, transverse section of mature segment, $\times 37$, B, mature segment $\times 37$, C, horizontal section of gravid segments, $\times 26$ (After Woodland, in 'Parasitology')

situated on the left side. The genital ducts pass dorsally to both the excretory vessels and nerve.

Muscular System The longitudinal muscle bundles are in two concentric layers, the inner one consisting of four dorsal and four ventral bundles, whilst the outer consists of from 60 to 80 small bundles. The circular muscle fibres lie externally to the longitudinal muscle bundles.

Excretory System There are two excretory vessels running along each lateral margin of the worm, each pair lies internally

to the row of testes on the same side Dorso-ventrally the two lateral vessels are in apposition, and apparently never communicate with each other posteriorly

Male Genitalia The worm is peculiar in that all the three testes are situated externally to the excretory vessels, one being poral and the other two aporal (one behind the other) The cirrus sac is large and divided into a small external portion provided only with longitudinal muscles for the protrusion of the cirrus, and a large internal portion provided only with circular muscles for the propulsion of the spermatozoa The cirrus is unarmed The whole of the vas deferens outside the sac is converted into a vesicula seminalis, it is long, wide, coiled upon itself, and situated slightly ventrally to the internal portion of the sac, but it receives the three vasa efferentia dorsally

Female Genitalia The ovary is large and bilobed, and immediately behind and ventrally to it is the vitelline gland The large median shell gland is situated ventrally to the inner end of the vagina and dorsally to the isthmus The vagina opens ventrally to the cirrus sac, and its terminal part is slightly dilated, it then narrows until it reaches the excretory vessels, when it broadens again and runs backwards to the dorsal surface of the ovary

The uterus is a transverse sac extending to the margins of the segment, and having dilated extremities

(26) *Hymenolepis clerci* Fuhrmann, 1924

Synonyms — *Hymenolepis interruptus* Clerc, 1906 (Apparently not *Hymenolepis interrupta* (Rud., 1802) Fuhrmann, 1906)

Wardium clerci (Fuhrmann, 1924) Mayhew, 1925

As the specific name *interrupta* was preoccupied by Rudolphi's species, Fuhrmann (1924) changed the name of Clerc's species to *H. clerci*

H. interrupta (Rudolphi, 1802) Fuhrmann, 1906, is referred by Mayhew to the genus *Weinlandia*, whilst *H. interruptus* Clerc, 1906 (= *H. clerci* Fuhrmann, 1924) is placed by him in the genus *Wardium* The distinction between Rudolphi's species and Clerc's species is not well defined In both the hooks are approximately the same size and have almost the same shape, the testes have the same distribution Rudolphi's species attains a length of about 10 cm and occurs in Charadriiformes, whilst Clerc's measures 3.5 to 4 cm and is found in sparrows (Passeriformes)

From *Passer montanus*, Rangoon Meggitt

The worm measures from 3.5 to 4 cm in length and has a breadth of 570 μ The segments are all broader than long except a few of the most posterior The genital pores are

unilateral and are situated slightly in front of the middle of the lateral margin of the segment

The scolex, according to Meggitt, has a length of from 166 to 180 μ , but Clerc states that it measures 450 μ . The rostellum has a length of 128 μ and a breadth of 60 μ . The rostellar hooks each measure from 20 to 24 μ and are arranged in a single row. A short neck is present, its length varying with the degree of contraction of the worm.

Muscular System The longitudinal muscles consist of two layers separated by discontinuous circular fibres. The outer longitudinal muscle layer consists of small fibres closely set together, the inner layer, according to Meggitt, consists of from 18 to 20 very much larger ones, separated by large intervals, Clerc, however, gives a much lower number, namely, 8. At the junction of the proglottides there is a sheet of numerous strong transverse muscles together with weaker dorso-ventral fibres.

Excretory System There are two longitudinal vessels, one dorsal and one ventral, running along each side of the worm, they bend outwardly in the centre of each segment and inwardly at the junction of the segments. The dorsal and ventral vessels communicate with each other at the posterior margin of each segment. The dorsal vessel remains of the same width throughout the strobila, but the ventral vessel gradually increases in size until it becomes four times the diameter of the dorsal vessel.

Male Genitalia The testes are situated dorsally, one being poral, the other two aporal, of the latter, one is situated anterior to and a little external to the other, all three testes lie within the excretory vessels. When the strobila is strongly contracted the three testes may occasionally lie almost in a straight line. The cirrus sac is small and cylindrical, extending just median to the dorsal excretory vessel, it measures 89 by 25 μ and is situated dorsally to the nervous and excretory vessels, its inner end is occupied by a large internal seminal vesicle, it opens dorsally into a small genital atrium. The cirrus is unarmed. The vas deferens is cylindrical and curved, having the concavity directed ventrally, it dilates into a vesicula seminalis and then splits into three vasa efferentia.

Female Genitalia The ovary is ventral and median, extending laterally nearly to the ventral excretory vessel. The vagina opens into a genital atrium ventrally, near the internal vesicula seminalis it widens considerably into a receptaculum seminis which is situated anteriorly in the poral half of the segment, it measures about 100 μ in length by 60 μ in breadth. The vitelline gland is spherical and is situated in the posterior concavity of the ovary. The shell gland consists of glandular cells surrounding the oviduct. The uterus at first is a narrow band

lying transversely and dorsally to the ovary. It subsequently develops two ventral wings, and its cavity becomes divided by septa which arise from its walls. Eventually the two wings coalesce and the uterus becomes sac-like, extending beyond the excretory vessels. The oncosphere measures from 34 to 38 μ by 29 μ and the embryonic hooks 9 to 14 μ .

SPECIES INQUIRENDÆ

- (1) *Hymenolepis* sp. (? *H. collaris* Batsch, 1786) Fuhrmann, 1908
= *H. sinuosa* Cohn, 1901

From *Anas pæclorhyncha*, Zoological Gardens Calcutta Southwell

A number of specimens, all without a scolex, have been recorded from the above host. The worms measured from 6 to 8 cm. in length and the greatest breadth was 2 mm. The posterior segments were as long as broad, and some of the anterior segments were bell-shaped and much longer than broad—almost certainly an artificial condition.

Each segment contains three testes and each one is lobed, one testis is situated on the pore side and the other two aporally, one being directly anterior to the other. The ovary lies between the poral testis and the aporal testes. The accessory sac is well developed.

- (2) *Hymenolepis fasciata* (Rudolphi, 1810) ? Krabbe, 1869

From ducks, Madras Southwell

According to Krabbe (1869), it is impossible to state definitely which particular cestode from the goose is referred to under the specific name *fasciata*, but he restricted the species to those cestodes which are provided with 8 hooks on the rostellum, found in geese. Apparently the *Tænia fasciata* of Rudolphi, 1810, is the same as *T. setigera* Frohlich, 1789.

Mayhew (1925), however, includes *H. fasciata* (Rudolphi, 1810) under "*Species inquirendæ*." The writer in 1922 referred to the species *H. fasciata* a worm obtained from the above host. It was so named because the head was armed with a simple crown of hooks and it agreed generally with the description given by Stiles and Hassall (1896). The identity of the parasite is, however, uncertain.

- (3) *Hymenolepis* sp. (? *microcephala* (Rudolphi, 1819) Fuhrmann, 1906)

From the white stork (*Ciconia alba*), Zoological Gardens, Calcutta Southwell

The specimens were so badly preserved that it was impossible to make any definite statement beyond the fact that they belonged to the genus *Hymenolepis*.

(4) *Hymenolepis capillarioides* Fuhrmann, 1906

Synonym — *Wardium capillarioides* (Fuhrmann, 1906) Mayhew, 1925

From a snipe, Berhampur, Bengal Southwell

The worms recorded by Southwell from the above host have unfortunately been lost, and it is therefore impossible to check this diagnosis

(5) Gaiger (1915) recorded an undetermined species of *Hymenolepis* from the dog It is improbable that the worm belongs to this genus(6) *Hymenolepis* sp Southwell, 1916

Synonym — *Diocthis americana* of Southwell, 1916

From (1) the domestic fowl and (2) *Dendrocitta* sp, Zoological Gardens, Calcutta Southwell

The worm attains a length of 2.5 cm and a breadth of 600 μ . The genital pores are situated at the centre of the lateral margin of the segment. The rostellum is armed with 10 hooks, each having a length of about 65 μ .

(7) *Hymenolepis* sp Southwell, 1916

From the black Australian swan (*Chenopsis atrata*), Berhampur, Bengal Southwell

A number of specimens measuring 1.7 cm in length and 600 μ in breadth, all without a head and badly preserved, have been recorded from the above host. Specific determination cannot be arrived at.

The cirrus sac in these worms was enormous, extending two-thirds across the segment. The cirrus was very long and covered with minute spines.

(8) *Hymenolepis* sp Southwell, 1916

From a woodpecker (*Chrysophlegma flavinucha*), Zoological Gardens, Calcutta, India Southwell

The specimens measured 2.5 cm in length and were extremely delicate. They were so badly preserved that a specific diagnosis was impossible.

(9) *Hymenolepis* sp (? *asymetrica*) Fuhrmann, 1918.

From the red-billed blue magpie (*Urocissa occipitalis*), Zoological Gardens, Calcutta Southwell

The worm measured 10 mm in length and was immature. Its identity is quite uncertain.

(10) *Hymenolepis* sp Southwell, 1922.

From *Emberiza luteola*, Zoological Gardens, Calcutta. Southwell

Numerous fragments, without heads, in a bad state of preservation, have been recorded from the above host. The segments each contained three testes.

(11) *Hymenolepis* sp. Southwell, 1922

From *Phalacrocorax carbo*, Chilka Lake, Orissa. Southwell

A few fragments and a damaged head from the above host could not be definitely identified. They appeared, however, to resemble *H. breviannullata* Fuhrmann, 1906 fairly closely.

It is unlikely, however, that the specimens belong to this species, which occurs in the Somaliland ostrich (*Struthio molybdophanes*).

(12) *Hymenolepis* sp. Southwell, 1922

Synonym — *Hymenolepis naja* of Southwell, 1922, not Dujardin, 1845

From a magpie (*Copsychus saularis*), Zoological Gardens, Calcutta. Southwell

The worm measures about 10 mm in length and has a breadth of about 200 μ . All the segments are broader than long, and the unilateral genital pores are situated in front of the middle of the lateral margin of the segment. The head is armed with 10 hooks, each having a length of about 30 μ . Of the three testes, two are situated aporally. It is impossible to determine definitely to which species the worm belongs.

(13) *Hymenolepis* sp. Southwell, 1922

Synonym — *Choanotæmia* (? *octocantha* Krabbe, 1869) of Southwell, 1922

From a snipe, Berhampur, Bengal. Southwell

Two badly preserved specimens recorded from the above host resembled in some detail the species described by Krabbe from *Anas boschas* under the name *H. octocantha*. It is, however, improbable that the species from the snipe is the same, although closely related.

(14) Moghe (1926) recorded an undetermined species of *Hymenolepis* from a rat, it is probably *H. murina* or *H. diminuta*

(15) *Hymenolepis* sp. Joyeux & Houdemer, 1928

From pigeons, Kasauli, India. Korke

Incomplete specimens. The largest measured 6.6 cm in length and 500 μ in breadth, all the worms were without heads and all the segments were immature. The musculature was well developed, the longitudinal muscles are in two concentric irregularly scattered bundles. The transverse muscles

Genus II FIMBRIARIA Fröhlich, 1802.

Scolex small and usually lost, with rostellum armed with a single row of hooks. Strobila without true segments but with transverse grooves, giving the appearance of segments. Pseudoscolex retains the true segmentation. Excretory system consists of several pairs (three and eleven in the two known species) of longitudinal excretory vessels. Genital pores marginal, unilateral, and on the right-hand border of the strobila. Testes three in number for each cirrus sac. Ovary reticular, or forming network extending through the strobila, or a simple ovary for each set of reproductive organs. Uterus reticular.

Type-species — *Fimbriaria fasciolaris* (Pallas, 1781).

Fimbriaria fasciolaris (Pallas, 1781) Wolff, 1900 (Fig. 312)

Synonyms — *Fimbriaria malleus* (Goeze, 1782) Fröhl, 1802

?*Fimbriaria mitra* Fröhl, 1802

Fimbriaria mitrata Blainville, 1828, and Nordmann, 1840

Fimbriaria plana Linstow, 1905

Notobothrium allicum Linstow, 1905

From (1) *Fuligula cristata*, Loktak Lake, Assam. Southwell.
(2) Ducks, Rangoon. Meggitt.

The worm measures from 2.5 to 42.5 cm. in length and has a maximum breadth of 5 mm. The external segmentation is somewhat indistinct, being obscured by rugosities, and the reproductive organs appear not to be definitely segmented. The true head is very small and extremely unstable, being almost always lost, but when present it is armed with a single row of 10 hooks, each of which measures from about 17 to 22 μ . When lost, the head is replaced by a pseudoscolex. This consists of the modified anterior part of the strobila, usually lying at an angle with the rest of the worm. It may measure up to 5 mm. in length and contain as many as 200 segments each one representing from 4 to 12 separate segments which have fused together. They do not contain genital organs. In the absence of the true head the explanation of the manner in which the worm grows presents certain difficulties.

from Bengal into Europe, there is some uncertainty as to whether the ducks were infected in Bengal or Europe. Cysticercoids occur in copepods, such as *Cypria ophthalmica* and *Cyclocypris globosa*.

(2) *Echinocotyle uralensis* Clerc, 1902 (Fig 311)

From (1) Snipe, Potsenham, Loktak Lake, Manipur, Assam Southwell (2) Snipe (*Capella* sp), Berhampur, Bengal. Southwell

The worm attains a length of about 4 cm and a breadth of 1.2 mm. The segments are all longer than broad, and the genital pores are situated in the anterior part of the lateral margin of the segment. The head bears a long rostellum armed with 10 hooks, each measuring $66\ \mu$. The suckers are

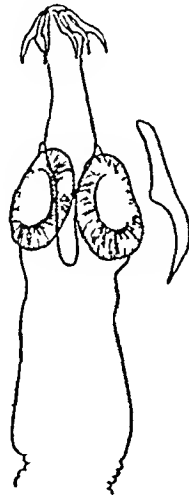


Fig 311 —*Echinocotyle uralensis* Head, $\times 90$, rostellar hook, $\times 240$ (Original)

strongly developed and are armed with a large number of minute hooks arranged in rows as in *E. rosseteri*.

The musculature consists mainly of longitudinal fibres which are arranged in a double layer of bundles.

There are three testes arranged in the form of a shallow V, the apex pointing posteriorly. The vas deferens dilates into a rather elongated seminal vesicle. The cirrus sac is relatively small. A sacculus accessorius is always present.

The ovary is bilobed and situated ventrally, immediately posterior to it is a simple, somewhat globular vitelline gland. The shell gland is minute and lies dorsally to the ovary. The vagina lies dorsally to the cirrus sac and dilates into an enormous receptaculum seminis. The uterus is a sac with irregular walls.

Genus II FIMBRIARIA Frohlich, 1802.

Scolex small and usually lost, with rostellum armed with a single row of hooks. Strobila without true segments but with transverse grooves, giving the appearance of segments. Pseudoscolex retains the true segmentation. Excretory system consists of several pairs (three and eleven in the two known species) of longitudinal excretory vessels. Genital pores marginal, unilateral, and on the right-hand border of the strobila. Testes three in number for each cirrus sac. Ovary reticular, or forming network extending through the strobila, or a simple ovary for each set of reproductive organs. Uterus reticular.

Type-species — *Fimbriaria fasciolaris* (Pallas, 1781)

Fimbriaria fasciolaris (Pallas, 1781) Wolff, 1900 (Fig 312)

Synonyms — *Fimbriaria malleus* (Goeze, 1782) Frohl, 1802

 ? *Fimbriaria nitra* Frohl, 1802

Fimbriaria nitrata Blainville, 1828, and Nordmann, 1840

Fimbriaria plana Linstow, 1905

Notobothrium arcticum Linstow, 1905

From (1) *Fuligula cristata*, Loktak Lake, Assam Southwell
(2) Ducks, Rangoon Meggitt

The worm measures from 2.5 to 42.5 cm in length and has a maximum breadth of 5 mm. The external segmentation is somewhat indistinct, being obscured by rugosities, and the reproductive organs appear not to be definitely segmented. The true head is very small and extremely unstable, being almost always lost, but when present it is armed with a single row of 10 hooks, each of which measures from about 17 to 22 μ . When lost, the head is replaced by a pseudoscolex. This consists of the modified anterior part of the strobila, usually lying at an angle with the rest of the worm. It may measure up to 5 mm in length and contain as many as 200 segments, each one representing from 4 to 12 separate segments which have fused together. They do not contain genital organs. In the absence of the true head the explanation of the manner in which the worm grows presents certain difficulties.

Muscular System This is well developed. The longitudinal muscles consist of a single layer of rather large bundles lying immediately external to the well developed circular muscles, dorso-ventral fibres are also well developed.

Male Genitalia Each apparent segment contains 18, 21, or 24 testes irregularly disposed, with 6, 7, or 8 cirrus sacs respectively, indicating that each apparent segment is formed by the fusion of 6, 7, or 8 segments, and that, like the species of the genus *Hymenolepis*, each true segment contains three testes.

The cirrus sac is a large, prominent, muscular structure containing an internal seminal vesicle. The cirrus is strongly armed with powerful hooks. An external seminal vesicle is also developed.

Female Genitalia. The ovaries are in the form of transverse tubes occupying the whole length of the parenchyma, close together. Fuhrmann states that there is a single cylindrical

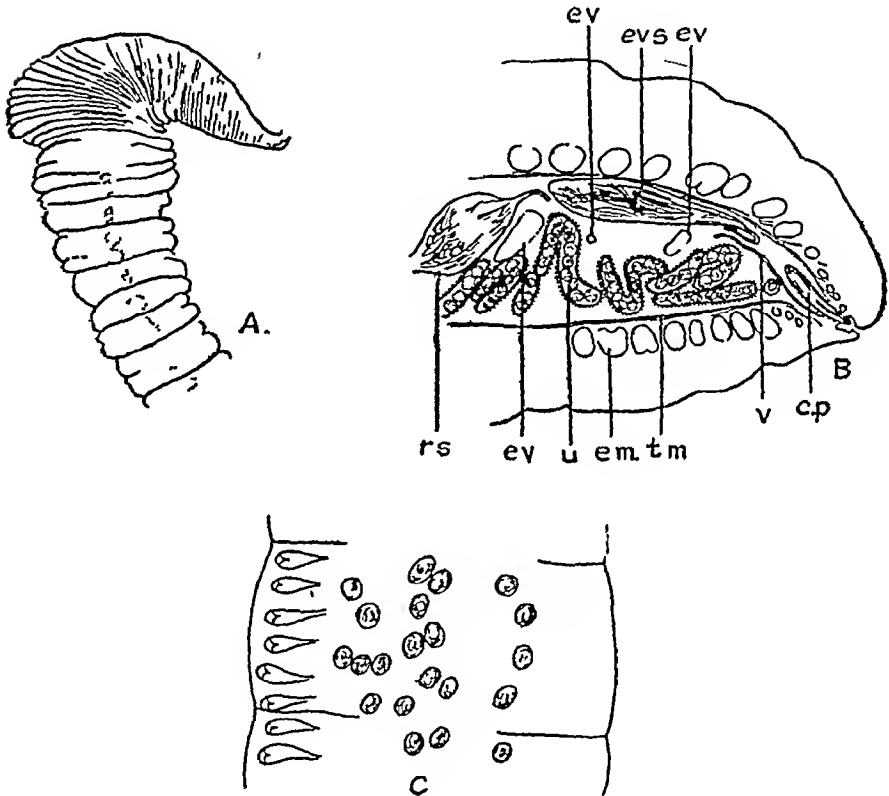


Fig 312 — *Fimbriaria fasciolaris*. A, pseudoscolex, B, transverse section of oral side of segment, C, segments showing the number of testes (18) in relation to cirrus pouches (6). Magnification unknown. (After Fuhrmann.)

and continuous ovary throughout the strobila. From this common ovary arise hundreds of oviducts, on the vagina is developed a large receptaculum seminis in the form of an undulating tube. The vitelline glands are lobed and do not appear to fuse, the uterus at first has the same shape as the ovary, i.e., it is composed of a transverse tube which is situated ventrally to the ovary. It gives off evaginations

dorsally into the parenchyma, each one contains several eggs. Normally the eggs pass into these vertical ramifications, and in the meantime the uterine cavity becomes reticulated. The gravid strobila contains one single continuous uterus which opens to the exterior by numerous apertures situated on both sides of the median line and irregularly disposed. The egg measures up to $80\ \mu$ in diameter, larval forms occur in the Ostracod *Diaptomus vulgaris*.

Family V DILEPIDIDÆ Railliet & Henry, 1909

Synonym —Dilepinidæ Fuhrmann, 1907

Scolex furnished with a retractile rostellum armed with one or more rows of hooks, rarely unarmed. Genital organs single or double. Genital pores marginal and either single or double, in the first case they may be unilateral, or regularly or irregularly alternate. Testes more or less numerous, not less than six in each segment. Uterus very variable in form. Oncosphere with three envelopes.

Type-genus —*Dilepis* Weinland, 1858

Meggitt (1924) writes "As the genus *Dilepis*, after which Fuhrmann named his subfamily, differs from the majority of the other genera in several respects (unilateral genital pores instead of alternating, genital ducts pass dorsally instead of between longitudinal excretory vessels, testes occasionally reduced to 7), I suggest *Anomotaenia* as the type, it corresponding more nearly to the average genus in this subfamily." In 1927 he further draws attention to the fact that the species of "*Dilepis*, type-genus of the subfamily Dilepininæ, sometimes has only 7 testes, the pores are unilateral and the genital ducts pass dorsally to the excretory vessels, whilst in the remainder of the subfamily eight genera have unilateral pores and 14 genera alternating pores. Further, in twelve genera the genital ducts pass between the vessels, whilst in five genera they are dorsal to them, and all these genera have numerous testes, at least twelve."

In 1927 he pointed out that there are four genera with similar characteristic hooks, viz., *Bruterina* Fuhrmann, 1902, *Cyclorchida* Fuhrmann, 1907, *Deltokeras* Meggitt, 1927, and *Sphærouterina* Johnston, 1914. The first and last have a paruterine organ, whilst in the other two the uterus is persistent. Fuhrmann considers that *Sphærouterina* is a synonym of *Bruterina*, the only difference between these two genera being the number of testes. Following precedents "where condition of uterus is subordinated to armature of the scolex," Meggitt

erects a new family for the reception of these genera, viz —

Family *Buterinidæ* Rostellum armed with triangular hooks

Subfamily 1 *Buterininæ* Meggitt, 1927 Uterus replaced by paruterine organ Type-genus —*Buterina* Fuhrmann, 1902

Subfamily 2 *Deltokernæ* Meggitt 1927 Uterus persistent Type-genus —*Deltokeras* Meggitt, 1927

It will be noted that the only character ascribed to the family is the possession of characteristic hooks It is true that such precedents do exist, the family *Davaineidæ*, for instance, may be said to be characterized by the shape and size of the hooks on the rostellum Whether Meggitt's proposed new family stands or not depends on whether the shape of a hook is to be considered of greater systematic value than a paruterine organ If the new family is accepted, then a complete revision of the classification of the family *Dilepididæ* will be necessary Under the circumstances it appears to the writer desirable to retain the older classification and to place Meggitt's genus *Deltokeras* (correctly *Deltoceras*) in the subfamily *Dilepininæ* (correctly *Dilepidinæ*) Fuhrmann, 1907

Key to Subfamilies

Uterus persistent	<i>Dilepidinæ</i> , p 154
Uterus breaks up into egg capsules	<i>Dipylidinæ</i> , p 175
Uterus with one or more paruterine organs	<i>Paruterininæ</i> , p 184

Subfamily I *DILEPIDINÆ* Fuhrmann, 1907

Rostellum armed with a double or single row of hooks, or unarmed (*Uncinaria*) Genital pores usually pass between the dorsal longitudinal excretory vessels Testes numerous Uterus sac-like, more or less lobed, occasionally ring-shaped (*Cyclostera*) or divided by septa (*Bancroftiella*), never replaced by egg-capsules

Type-genus —*Dilepis* Weinland, 1858

Key to Genera

1 Rostellum armed with a single row of hooks	2
Rostellum armed with a double row of hooks	3
Rostellum unarmed (?)	<i>PFENTORCHIS</i> , p 171
2 Genital pores unilateral	<i>LATERIPORUS</i> , p 157
Genital pores regularly alternate	<i>AMCEBOTÆNIA</i> , p 165
Genital pores irregularly alternate	<i>CHOANOTÆNIA</i> p 159

3	Genital pores unilateral	4
	Genital pores irregularly alternate	5
4	Cirrus armed with powerful spines	GRYPORHYNCHUS, p 170
	Cirrus not armed with powerful spines	6
5	External segmentation distinct, ovary symmetrical	ANOMOTÆNIA, p 163
	External segmentation indistinct, ovary poral	PARVIROSTRUM, p 167
6	Genital canals pass dorsally to longitudinal excretory vessels	DILEPIS, p 155
	Genital canals pass between longitudinal excretory vessels	7
7	Testes surrounding female genitalia	CYCLOLORCHIDA, p 173
	Testes posterior and lateral to female genitalia	DELTOCERAS, p 172

Genus I DILEPIS Weinland, 1858

Rostellum armed with a double crown of hooks, each with long dorsal and short ventral root and long blade. Genital pores unilateral, genital canals pass dorsally to longitudinal excretory vessels and nerve, testes surrounding the female glands laterally and posteriorly, typically numerous (40 to 50), but may be reduced in number (7). Uterus sac-like, with few or numerous out-pocketings. Adults in birds.

Type-species — *Dilepis angulata* (Rudolphi, 1810) Cohn, 1899

(1) *Dilepis campylancristrota* (Wedl, 1855) Fuhrmann, 1908. (Fig 313)

Synonym — *Tænia campylancristrota* Wedl, 1855

From (1) The paddy-bird (*Herodias garzetta*), Berhampur, Bengal Southwell (2) The pond-heron (*Ardeola grayi*), Zoological Gardens, Calcutta Southwell

The worm is very small, attaining a maximum length of 7 mm only and a breadth of 500 μ . It consists of from 20 to 30 segments, the last ones measuring about 220 μ in length and 240 μ in breadth. The genital pores are unilateral and are situated in the anterior third of the lateral margin of the segment. The head has a length of about 80 μ and a breadth of 143 μ . The suckers have a diameter of about 42 μ . The rostellum is armed with about 20 hooks arranged in a double row, those in the anterior row have a length of from 22 to 30 μ and those in the posterior row of from 7 to 12 μ . There is no neck.

There are about seven or eight testes, which increase considerably in size, of these, three are situated in the middle of the segment behind the ovary and four aporally. The cirrus sac extends more than half the distance across the segment. The cirrus is armed with minute spines.

The ovary is bilobed and is situated in front of the testes. The uterus is a simple sac at first, consisting of two spherical sacs communicating with each other.

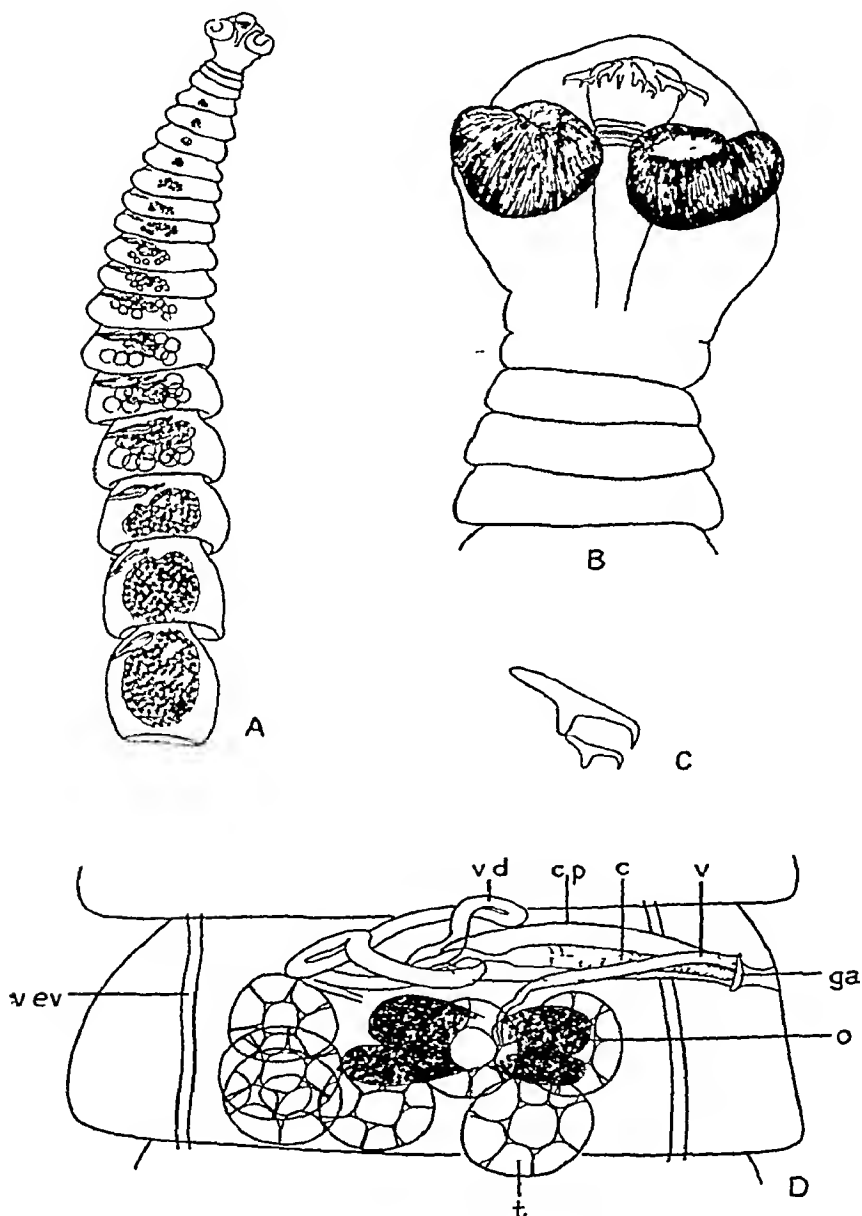


Fig 313 —*Dilepis campylancristota* A, entire worm, $\times 47$, B, head, $\times 240$, C, rostellar hooks, $\times 530$, D, mature segment, $\times 200$ (Original)

(2) *Dilepis* sp

Under the name *Dilepis cypselina* Neslobinsky, 1911, Southwell recorded a fragment and a head of a worm from the intestine of a tree-pie (*Dendrocitta leucogaster*), Zoological Gardens, Calcutta

The head was armed with a double crown of hooks, all of the same size, and measuring about $18\ \mu$. They were peculiar in that they were rose-thorn-shaped, and resembled fairly closely the hooks on the head of species of *Dipylidium*. The genital pores were unilateral and the cirrus sac was situated anteriorly, extending almost to the longitudinal excretory vessels

The species is probably new, but in the absence of material it has been thought undesirable to erect a new species

Genus II *LATERIPORUS* Fuhrmann, 1907

Rostellum with a single crown of from 12 to 16 hooks, with long dorsal and short ventral roots and well-developed blade. Genital pores unilateral. Genital canals pass dorsally to longitudinal excretory vessels. Testes 12 to 30, posterior or lateral to female glands. Uterus sac-like. Adults in birds

Type-species —*Lateriporus teres* (Krabbe, 1869)

(1) *Lateriporus spinosus* Fuhrmann, 1922 (Fig 314)

Synonym —*Dilepis macrosphinctes* Southwell, 1922

From *Ardea purpurea*, Zoological Gardens, Calcutta Southwell

The specimens attain a length of about 10 cm and a maximum breadth of about 2 mm. All the segments are broader than long and their posterior lateral corners are salient. The genital pores are unilateral and are situated at the extreme anterior angle of the lateral margin of the segment. In some segments the genital papilla is prominent

Muscular System The longitudinal muscles are not well developed, they consist of about 12 small internal bundles, external to which are a number of smaller bundles and separate fibres

Excretory System The dorsal excretory vessel is extremely small and difficult to see, but the ventral vessel is large and conspicuous. The genital ducts pass dorsally to the latter

Male Genitalia There are about 30 testes, although Fuhrmann gives the number as 26. They completely surround the female organs, but do not extend beyond the ventral excretory vessel. A vesicula seminalis is absent. The cirrus sac is very large and extends almost to the middle of the segment. Fuhrmann states that it may extend as far as the

poral excretory vessel, but probably this only takes place when the segment is exceptionally elongated. Within the sac the vas deferens is much coiled, the cirrus is large and armed with long closely-set spines.

Female Genitalia The ovary is a conspicuous bilobed organ, each half being transversely elongated and narrow

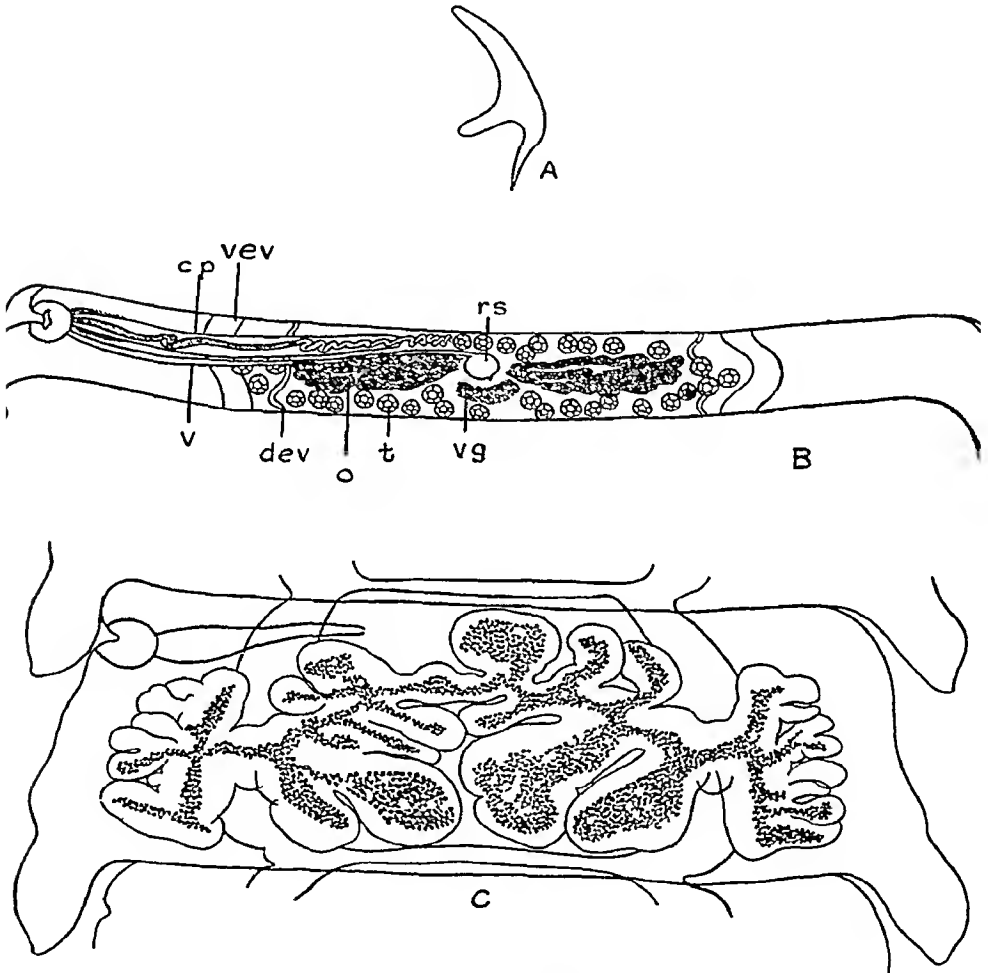


Fig 314 —*Lateriporus spinosus* A, rostellar hook, $\times 450$, B, mature segment, $\times 60$, C, gravid segment, $\times 60$ (Original)

antero-posteriorly, it is situated in the anterior part of the segment. Immediately behind it is the small vitelline gland. The vagina runs posteriorly to the cirrus sac, its terminal part is armed with fine hairs and it is very muscular. The remaining part of the vagina is narrow and only slightly

undulated Between the ovarian lobes it dilates into a small fusiform receptaculum seminis The uterus is a sac filling the entire segment and extending laterally to the excretory vessels The oncosphere has a diameter of about 16μ

Genus III CHOANOTÆNIA Railliet, 1896

Synonyms — *Icterotænia* Railliet & Henry, 1909

Parachoanotænia Lühe, 1910

Rostellum with a single crown of hooks Genital pores irregularly alternate Genital ducts pass between the longitudinal vessels Testes numerous, posterior Uterus sac-shaped Adults in birds and mammals

Type-species — *Choanotænia infundibuliformis* (Goeze, 1782)

Meggitt (1927) states that the three genera *Amæbotænia* Cohn, 1899, *Anomotænia* Cohn, 1900, and *Choanotænia* Railliet, 1896, are closely related, and that the characters separating them are insufficient for generic diagnosis, but, pending a complete revision, he retains them The writer agrees with Meggitt's opinion

Key to Species

- | | |
|---|------------------------------------|
| 1 Over 5 cm in length | <i>C infundibuliformis</i> , p 159 |
| Under 5 cm in length | 2 |
| 2 Head armed with more than 10 hooks | 3 |
| Head armed with less than 10 hooks | <i>C decacantha</i> , p 160 |
| 3 Cirrus pouch extending to middle of segment | <i>C magnimosa</i> , p 162 |
| Cirrus pouch not extending to middle of segment | 4 |
| 4 18 to 26 testes | <i>C barbaræ</i> , p 161 |
| 35 to 45 testes | <i>C galbula</i> , p 162 |

(1) *Choanotænia infundibuliformis* (Goeze, 1782) Railliet, 1896 (fig 315)

Synonymy extensive but including the following —

Tænia infundibuliformis Goeze, 1782

Tænia cuneata Batrch, 1786

Dicranulotænia infundibuliformis Goeze, 1782

Choanotænia in undibulum (Bloch, 1782) Cohn, 1899

Monopygidium infundibuliformis (Goeze, 1782) Clerc, 1903

From the domestic fowl, Rangoon Meggitt

The worm attains a length of from 5 to 20 cm and a maximum breadth of 1.5 mm The posterior segments are almost square The genital pores are irregularly alternate and are situated in the anterior third of the lateral margin of the segment The scolex has a diameter of from 60 to 70 μ and bears from 20 to 22 hooks, each measuring from 20 to 30 μ in length

There are from 20 to 30 testes situated in the median field posteriorly to the ovary The cirrus sac is small, not extending

to the longitudinal excretory vessels. The cirrus is long and armed with spines.

The ovary is bilobed, the aporal lobe being larger than the poral. According to Fuhrmann (1926) and Jouveux (1923), the uterus is unstable and breaks up into egg-capsules, each usually containing a single egg. If this is the case, then the species cannot be placed in the subfamily Dilepidinæ.

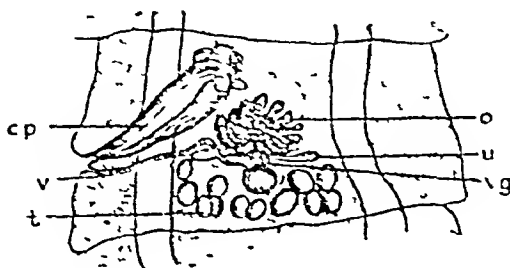


Fig 315 — *Choanotænia intundibuliformis* Mature segment, $\times 53$
(After Meggitt)

Meggitt (1926), however, states that the eggs are not in capsules, but the uterus becomes divided up into small cavities by the ingrowth of septa from the uterine wall, the cavities being in communication with each other. The egg is oval and measures from 32 to $40\ \mu$ by 36 to $50\ \mu$. The oncosphere measures 32 by $22\ \mu$ and the hooks in the egg $18\ \mu$.

Intermediate hosts — The dung-beetle (*Geotrupes sylvaticus*) and the house-fly (*Musca domestica*)



Fig 316 — *Choanotænia decacantha* Rostellar hooks, magnification unknown (After Fuhrmann)

(2) *Choanotænia decacantha* Fuhrmann, 1913. (Fig 316)

From a snipe (*Capella* sp.), Berhampur, Bengal. Southwell.

The worm attains a length of about 6 mm and a breadth of $300\ \mu$. It consists of from 40 to 50 segments, the last ones being longer than broad, the genital pores are regularly alternate and are situated in the anterior part of the lateral margin of the segment. The scolex has a breadth of 2 mm .

The rostellum is armed with a single crown of 10 hooks, each having a length of 20 or 21 μ

There are from 13 to 16 testes. The cirrus sac has a length of about 100 μ

The ovary is large, bilobed, and has a breadth of 160 μ . Immediately posterior to it is the vitelline gland, which has a diameter of 50 μ . The receptaculum seminis is prominent. The egg measures about 24 μ and appears to be isolated in the parenchyma in fully gravid segments.

(3) *Choanotænia barbara* Meggitt, 1926 (Fig 317)

Synonym — *Choanotænia innominata* Meggitt, 1926

From (1) *Passer montanus*, Rangoon Meggitt (2) a finch, genus and species unknown, Rangoon Meggitt

The worm varies in length from 2 to 3 cm and has a maximum breadth of 850 μ . The genital pores are situated almost at

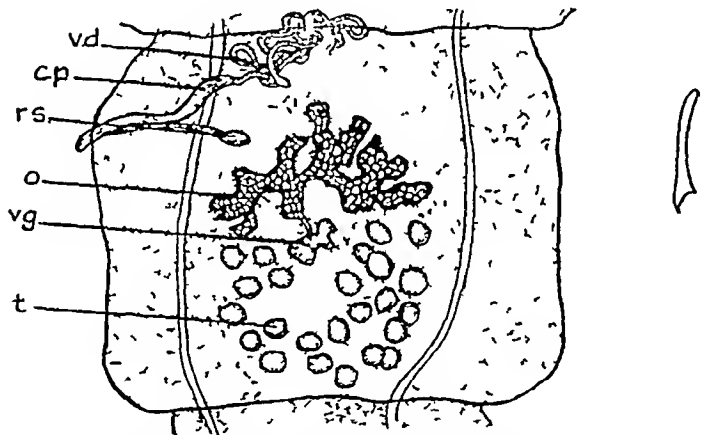


Fig 317 — *Choanotænia barbara*. Rostellar hook, $\times 900$, mature segment, $\times 80$ (After Meggitt, in 'Parasitology')

the anterior corner of the margin of the proglottis. The scolex has a diameter of 20 μ , the rostellum, which measures 10 μ in diameter, is armed with 23 hooks, each having a length of from 15 to 17 μ .

Male Genitalia. There are from 18 to 26 testes situated posteriorly to the ovary, the cirrus sac attains a maximum length of 190 μ and extends internally to the longitudinal excretory vessels.

Female Genitalia. The ovary is much lobed, the vitelline gland is situated slightly on the poral side and faces towards the genital pore. The uterus is sac-like, in gravid segments it extends to the excretory vessels, and its wall becomes a little indistinct.

(4) ? *Choanotænia galbulæ* (Zeder, 1803) Cohn, 1899 (Fig 318)

Synonym — *Tænia galbulæ* Zeder, 1803 var of *Tænia serpentina* Goeze, 1782

Meggitt records what he believes to be this species from a crow (*Corvus splendens insolens*) Rangoon Meggitt

The worm measured 1.7 cm in length and had a breadth of 400 μ . The proglottides were immature, the genital pore



Fig 318 — *Choanotænia galbulæ* Rostellar hooks, $\times 500$ (After Meggitt)

alternates, and is situated at the limit of the anterior quarter of the margin of the proglottides. The scolex measures from 250 to 350 μ in diameter. The rostellum has a diameter of 100 μ and extends to, or beyond, the posterior margin of the suckers. It is armed with 21 hooks, Meggitt gives their length as from "0.36 to 0.04 mm" (sic 0.036?). The testes appear to number from 35 to 45.

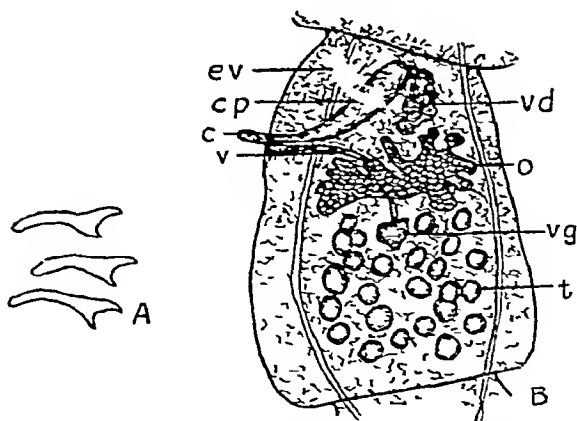


Fig 319 — *Choanotænia magnicirrosa* A, rostellar hooks, $\times 666$, B, mature segment, $\times 53$ (After Meggitt, in 'Parasitology')

(5) *Choanotænia magnicirrosa* Meggitt, 1926 (Fig 319)

From *Acridotheres tristis*, Rangoon Meggitt

The worm attains a length of 1.5 cm and a breadth of 600 μ . The genital pores are situated in the anterior third of the

margin of the proglottis. The scolex has a diameter of from 250 to 300 μ and the rostellum of from 80 to 90 μ . The latter organ extends beyond the anterior, but not beyond the posterior margin of the suckers, it is armed with a single circle of from 22 to 24 hooks, each having a length of 18 to 19 μ .

Male Genitalia There are 27 testes situated posteriorly to the ovary, larger and more closely aggregated than in *C. barbara*. The cirrus sac attains a maximum length of from 250 to 350 μ and extends obliquely to the middle of the anterior margin of the segment.

Female Genitalia The ovary is situated slightly on the pore side and is bilobed, there being a long isthmus joining the two wings, each part is subdivided laterally, the aporal half being larger than the poral. Gravid proglottides unknown.

(6) *Choanotænia* sp. Southwell, 1922.

From *Totanus hypoleucos*, Barkuda Island, Chilka Lake, Orissa. Southwell.

A number of specimens, all without heads, apparently belonging to the above genus, have been recorded, but their specific identity is quite uncertain.

Genus IV ANOMOTÆNIA Cohn, 1900

Synonym — *Diplochetos* Linstow, 1906

Rostellum armed with a double crown of hooks, with long dorsal and short ventral root and long blade. Genital pores irregularly alternate. Genital canals pass between longitudinal excretory vessels. Testes numerous, posterior, or also lateral to the female glands. Uterus sac-like. Adults in birds and mammals.

Type-species — *Anomotænia macrorhyncha* (Krabbe, 1869)

(1) *Anomotænia volvulus* (Linstow, 1906) Fuhimann, 1908 (Fig. 320)

Synonym — *Diplochetos volvulus* Linstow, 1906

From the yellow-wattled lapwing (*Lobipluvnia malabarica*) Weligatta, Ceylon. ² Willey.

The worm attains a length of about 85 mm and a maximum breadth of about 700 μ . All the segments are broader than long. The genital pores are irregularly alternate and are situated near the anterior extremity of the lateral margin of the segment. The scolex measures 260 μ in length by 350 μ in breadth. The rostellum is armed with 24 hooks, each having a length of 47 μ and arranged in a double row. The muscular system is well developed, the longitudinal fibres being in three layers of bundles, the largest one being internal.

The testes are numerous and are situated behind and laterally to the ovary. The cirrus sac extends one-fifth the distance across the segment and contains coils of the vas deferens. Median to the sac the vas deferens is also coiled. The ovary is bilobed, each half consisting of a number of follicles. The



Fig 320 — *Anomotænia volvulus*. Rostellar hook, magnification unknown (After Linstow)

vagina is situated ventrally to the cirrus sac, and the genital ducts pass between the longitudinal excretory vessels and dorsally to the nerve. Near the middle of the segment the vagina dilates into a large receptaculum seminis. The uterus is a large irregularly-shaped sac. Linstow stated that the egg measures 16 by 13 μ .

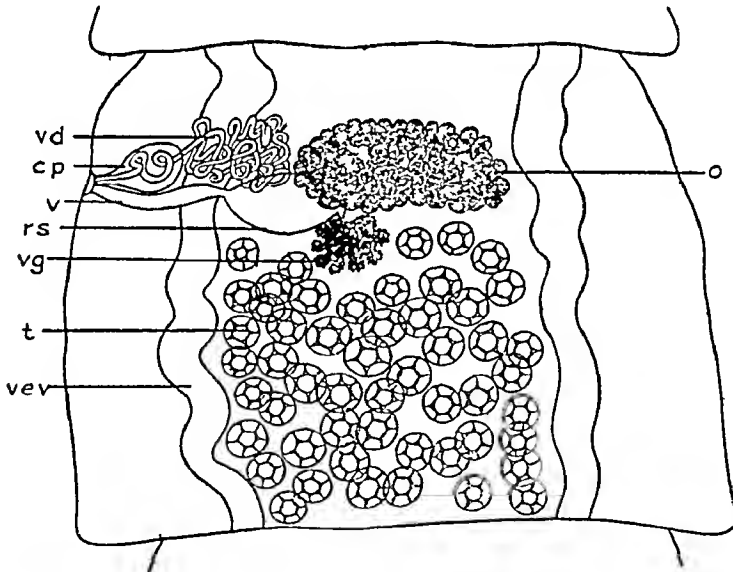


Fig 321 — *Anomotænia acollis*. Mature segment, $\times 90$ (Original)

(2) *Anomotænia acollis* Fuhrmann, 1907 (Fig 321)

From *Cuculus varius*, Zoological Gardens, Calcutta Southwell

The worm attains a length of 4 cm and a maximum breadth of 1 mm. The posterior segments measure at least 1.4 mm. in length and have a breadth of 900 μ . The genital pores

are irregularly alternate and are situated in the anterior fifth of the lateral margin of the segment. The head is cubical, attaining a breadth of $300\ \mu$. The rostellum bears about 40 hooks arranged in a double row, the hooks in one row measure $50\ \mu$ and in the other $46\ \mu$.

The testes are numerous and are situated behind the ovary, they occupy two-thirds the length of the segment between the excretory vessels. The cirrus sac is small, almost spherical, and has a diameter of $65\ \mu$, it does not extend to the water vessel. The vas deferens is notably conspicuous as a densely coiled, darkly staining mass immediately median and slightly anterior to the cirrus sac, the coils lie on each side of the water vessel.

The ovary is situated anteriorly, just behind and median to the vas deferens. It is bilobed and glandular in appearance, posterior to it is a conspicuous vitelline gland. The vagina is situated posteriorly to the cirrus sac. Internal to the excretory vessel it at once dilates into an enormous receptaculum seminis having a length of $84\ \mu$ and a breadth of $63\ \mu$. The eggs fill the entire segment and extend laterally to the excretory vessels, no trace of a uterine wall could be found.

(3) *Anomotænia* ² *constricta* (Molin, 1858) Cohn, 1903

From a crow. Punjab Civil Veterinary Department Southwell

One specimen, without a head, almost certainly belonging to the genus *Anomotænia*, has been obtained from this host. It is impossible, in the absence of a head, to state definitely to which species it belongs, but in its anatomical details it agrees with *A. constricta* (Molin, 1858).

Genus V AMÆBOTÆNIA Cohn, 1890

Rostellum armed with a single crown of hooks. Segments less than 30, broader than long. Genital pores regularly alternate. Testes rather numerous (12 or more), posterior. Uterus sac-like. Adults in birds.

Type-species — *Amæbotænia sphenoides* (Raillet, 1892)

Amæbotænia sphenoides Raillet, 1892. (Fig. 322)

SYNONYMS — *Iænia cuneata* Linstow, 1872

Iænia sphenoides Raillet, 1892

Dicranotænia cuneata Raillet, 1893

Dicranotænia sphenoides Raillet, 1896

Amæbotænia cuneata Cohn, 1900

From (1) The domestic fowl, Berhampur, Bengal. Southwell. Burma. Meggitt. (2) *Gallus ferrugineus*, Victoria Memorial Park, Rangoon. Meggitt.

The young worm is characteristically wedge-shaped, but this shape is lost as it becomes gravid. They have a maximum length of about 2 mm and the number of segments varies from 13 to 24. In a surface view the segment is much broader than long. The parenchyma is continuous throughout the strobila. In gravid segments the result is that ripe eggs from one segment may intrude into the adjacent segment, that is, in the posterior part of the strobila the segments are hardly separated from each other internally. The head is almost square and has a length of about $200\ \mu$, it is provided

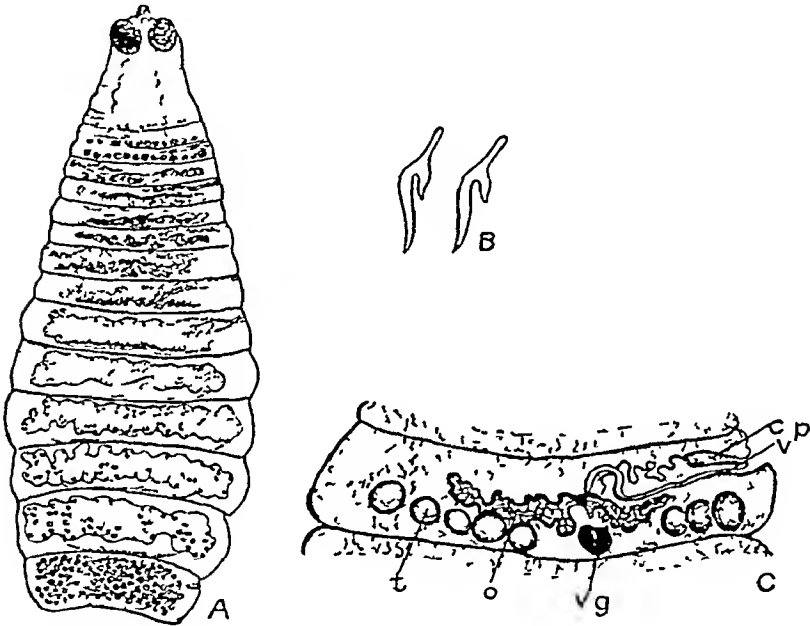


Fig 322 — *Amæbotæma sphenoides* A, entire worm, B, rostellar hook, magnification unknown (After Monnig) C, mature segment, $\times 68$ (After Meggitt)

with four suckers and a well-developed protrusible rostellum. The latter has a length of about $150\ \mu$ and a breadth of $40\ \mu$. It bears from 12 to 14 hooks, each measuring about $25\ \mu$ in length and having a shape characteristic of the species. The dorsal root is short and of the same length as the ventral root, with a comparatively long sinuous blade. The genital pores are regularly alternate and are situated close to the anterior corner of the segment.

Musculature As the worm is small, this system is naturally delicate. Beneath the cuticle is a single layer of longitudinal cuticular muscle fibres. Under the subcuticula there is a

well developed system of longitudinal muscles consisting of a number of distinct bundles. Circular muscles are apparently absent.

Male Genitalia The rudiments of the male genital organs appear in the second segment. There are 12 testes, each having a diameter of $45\ \mu$, and they lie in a single row on the dorsal surface at the posterior end of the proglottis. The vas deferens arises near the centre of the proglottis and runs to the anterior border, where it bends at right angles and becomes much coiled before it enters the cirrus sac. A vesicula seminalis is absent. The cirrus sac is cylindrical and bends upon itself.

Female Genitalia Female genital organs develop in about the fourth segment and persist to about the 14th. The ovary is placed a little on one side of the median line in the middle of the segment. At first it is butterfly-shaped. The vitelline gland lies behind and between the two wings of the ovary. The shell gland is situated posteriorly to the vitelline gland. The vagina runs behind the cirrus sac, its opening being surrounded by a sphincter muscle. It bends sharply forwards, then runs horizontally beyond the extremity of the cirrus sac, where it opens into a pear-shaped receptaculum seminis. The uterus is at first a simple transverse sac appearing in the 12th segment. When fully developed it overlaps the excretory vessels and develops a number of finger-like outgrowths which later fuse. The egg measures about $30\ \mu$.

Grassi and Rovelli state that in Lombardy the larval form of this worm occurs in the earthworm *Allolobophora foetida*. Meggitt (1926) records the larval form in Burma from *Allolobophora foetida*, *Pheretima peguana*, and *Pheretima* sp.

Genus VI PARVIROSTRUM Fuhrmann, 1907

Synonym — *Taufkia* Woodland, 1928

Fuhrmann described this genus as follows —

Strobila small, division into segments not well marked. Scolex large, rostellum small, armed with a double crown of hooks. Genital pores irregularly alternate. Reproductive glands very small. Testes in lateral portions of segment. Ovary and yolk gland towards pore side of segment. Uterus sac-like. Adults in birds.

Type-species — *Parvirostrum reticulatum* Fuhrmann, 1908

Up to the present only one species, viz., the type-species, of this genus has been described, a second species has now been obtained from an Indian vulture, species not known.

As the worm from India clearly falls within the genus, but exhibits new characters, it is necessary to re-define the genus *Parvirostrum* as follows —

Medium to large worms, division into segments not well marked. Scolex large, rostellum small, armed with a double crown of hooks. Genital pores irregularly alternate, reproductive glands very small, testes principally in two lateral groups, one group on each side, but a few testes may occur both anteriorly and posteriorly to the female genital organs. Ovary and vitelline gland slightly on the pore side of the segment. Uterus a narrow transverse tube expanding laterally in a number of small digitiform processes. Adults in birds.

Type-species — *Parvirostrum reticulum* Fuhrmann, 1908

The arrangement of the genital organs in this genus resembles closely that of the genus *Aporina* Fuhrmann, 1902. In the latter genus, however, the head is unarmed and the genital pores are apparently absent.

Parvirostrum magnisomum, sp. n. (Figs 323 & 324.)

From a vulture. Civil Veterinary Department, Lahore.

Two specimens were obtained, neither of which possessed a head. The total length of each worm is about 25 cm and the maximum breadth about 7 mm. They have a thickness of about 2 mm. Segmentation is indistinct even under low magnification. The cuticle of the worm is rugose and has a thickness of 6μ . All the segments are broader than long, the most posterior ones have a length of 1.7 mm and a breadth of 4 mm. The genital pores are irregularly alternate and are situated at the junction of the anterior and middle thirds of the lateral margins of the segment.

Musculature. The longitudinal muscles consist of numerous bundles arranged in a single layer, the largest ones being internal. A layer of circular fibres lies immediately internal to the longitudinal bundles.

Excretory System. The excretory system consists of a ventral vessel only on each side, and the genital ducts pass dorsally to it. The vessels communicate with each other by a prominent transverse duct in the posterior part of each segment, they vary in width within wide limits and are often dilated into large globular vesicles.

A single longitudinal nerve runs throughout the length of the worm laterally to the ventral excretory vessel.

Male Genitalia. The testes vary in number from about 70 to 110 in each segment, they are in two groups, one on each side of the segment, the greater number being situated aporally. In some segments a number of testes also occur anteriorly or posteriorly to the ovary, or both. The cirrus sac

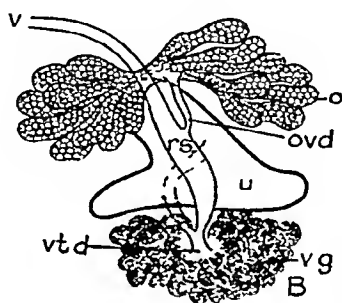
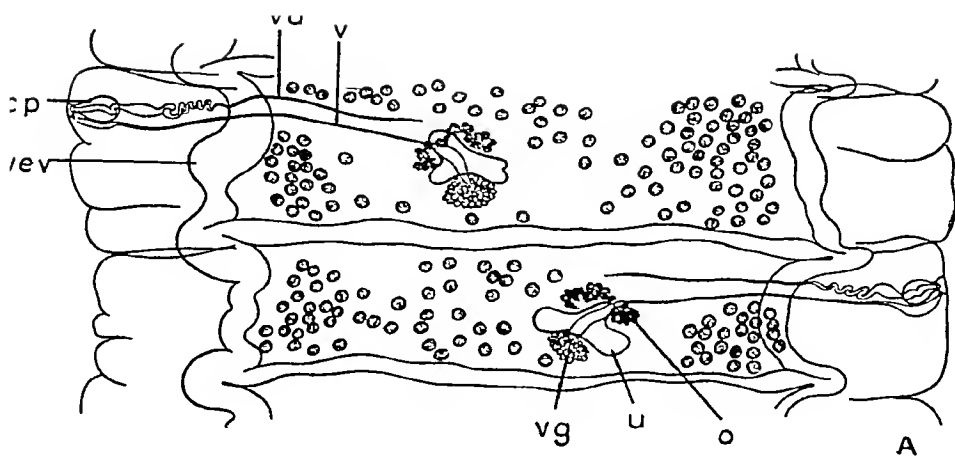
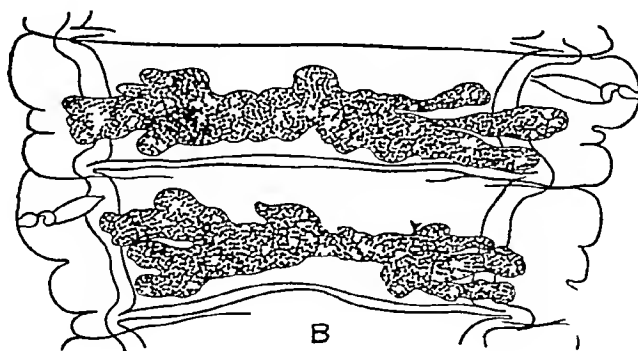
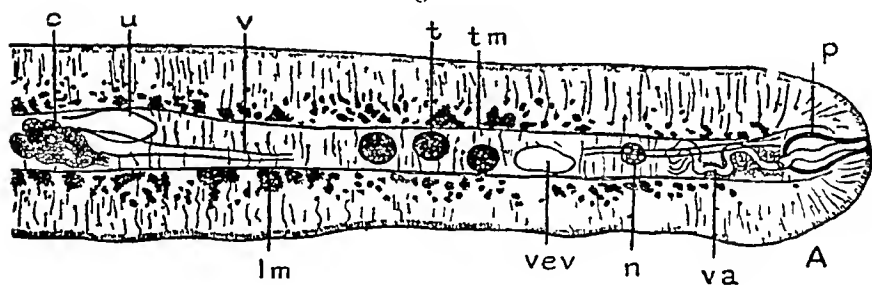


Fig 324



Paruostrum magnusomum, sp n

Fig 323 —A, mature segments, $\times 27$, B, enlarged view of genital ducts, $\times 90$
 Fig 324 —A, transverse section showing musculature, $\times 53$ B, gravid segments, $\times 12$

is very small and flask-shaped, extending only one-third the distance from the lateral margin to the excretory vessels. It has a length of 168μ and a breadth of 105μ , the cirrus is unarmed. The vas deferens dilates into a seminal vesicle immediately median to the cirrus sac, the dilated portion being surrounded by glandular cells. Between the seminal vesicle and the excretory vessels the vas deferens is much coiled, median to the excretory vessels it pursues an almost straight course and gradually disappears.

Female Genitalia The ovary is bilobed and situated in the poral half of the segment in the median transverse axis, posteriorly to it is a prominent vitelline gland. The vagina runs posteriorly to the cirrus sac, its terminal portion being dilated. It follows a slightly curved course to the mid-ovarian region, where it dilates into a prominent receptaculum seminis. The uterus arises as a Y-shaped outgrowth immediately dorsal to the ovary, gradually extending as a transverse tube, the lateral extremities of which eventually become digitate.

Genus VII **GRYPORHYNCHUS** Nordmann, 1832

Synonym — *Acanthocirrus* Fuhrmann, 1907

Rostellum armed with a double row of hooks. Genital pores unilateral. Genital canals pass between longitudinal excretory vessels. Root of cirrus with one or two pairs of powerful spines lying in special pockets. Testes few (6 to 8), posterior. Uterus sac-like. Adults in birds.

Type-species — *Gryporhynchus pusillus* Nordmann, 1832

Gryporhynchus pusillus Nordmann, 1832

Synonyms — *Tenia macropeos* Wedl, 1855

Dilepsis macropeos (Wedl, 1855) Clerc, 1906

Acanthocirrus macropeos (Wedl, 1855) Fuhrmann, 1907

From a pond-heron (*Ardeola grayi*), Zoological Gardens, Calcutta. Southwell

The worms are very small and attain a maximum length of about 5 mm and a breadth of 300μ . They consist of about 30 segments which are square. The genital pores are unilateral and situated in the anterior quarter of the lateral margin of the segment. The scolex has a breadth of 160μ and is armed with about 20 hooks, arranged in a double row, the large hooks measure 40μ in length and the small ones 23μ .

There are from six to eight testes in each segment. The cirrus sac extends two-thirds the distance across the segment, the cirrus has a length of 130μ and a breadth of 18μ , it is covered with extremely minute spinules, and at its base it bears powerful spines. The uterus is sac-like and appears to consist of two circular cavities, one on each side, which communicate with each other.

Genus VIII **PENTORCHIS** Meggitt, 1927

Rostellum unarmed (?) Genital pores unilateral Testes few, along posterior margin of segment, some external to excretory vessels External vesicula seminalis absent Receptaculum seminis large Uterus sac-like Adults in mammals

Type-species — *Pentorchis arkteos* (corr *arctus*) Meggitt, 1927

Pentorchis aictus Meggitt, 1927 (Fig 325)

From *Ursus malayanus*, Victoria Memorial Park, Rangoon Meggitt

The worm attains a length of 14 cm and a breadth of 1 mm, it is made up of numerous segments all of which are broader than long The genital pores are unilateral and are situated slightly behind the middle of the lateral margin of the segment, there is a small genital atrium, the mouth of which is surrounded by a definite sphincter muscle The scolex has a diameter of $380\ \mu$ and the rostellum one of $70\ \mu$ The latter extends posteriorly just beyond the middle of the suckers Meggitt

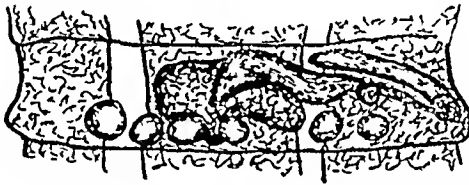


Fig 325 — *Pentorchis aictus* Mature segment, $\times 70$
(After Meggitt, in 'Parasitology')

was unable to discover any hooks, but points out that these might have been lost Details of the musculature are not known

Male Genitalia There are five testes, situated along the posterior margin of the segment, three of these being usually aporal and two poral The cirrus sac measures from 250 to $350\ \mu$ by 30 to $40\ \mu$, and extends in the median direction to the centre of the segment

Female Genitalia The ovary is sac-shaped and situated in the middle of the segment The vagina opens posteriorly to the cirrus sac, it is much coiled and, just median to the excretory vessel, it dilates into a large receptaculum seminis, which extends almost to the ovary Both the coils of the vagina and the receptaculum seminis may extend anteriorly to the cirrus sac The uterus is a slightly lobulated, persistent sac, divided up by a few very small incomplete septa, and when fully gravid it extends to the margin of the segment

Meggitt remarks that this species falls either in the *Dilepidinae* or *Hymenolepidinae*, thus — "From the latter it differs in the

absence of an external vesicula seminalis and in the course of the genital ducts, but agrees with it in the unilateral genital pores, the small number of testes and the short broad proglottides, it differs from the former in the last two characters, but agrees in all else. The present form is thus intermediate between the two, but has greater affinities with the former, the diagnosis of that subfamily must therefore be altered to 'Testes numerous or few (5)', the present form falls into line with *Dendrouterina*, *Clelandia* and *Cyclorchida*. From the first it is separated by the absence of a uterine reticulum, from the second by the arrangement of the testes and the absence of powerful cirrus spines, from the third by the absence of a genital papilla and vesicula seminalis and the position of the testes, and from all three by the small number of testes and the (?) unarmed rostellum."

Genus IX DELTOCERAS Meggitt, 1927

Rostellum armed with triangular hooks, genital pores unilateral. Testes numerous posterior and lateral to the female glands. Uterus persistent.

Type-species — *Deltokeras ornithos* (corr. *Deltoceras ornithium*) Meggitt, 1927

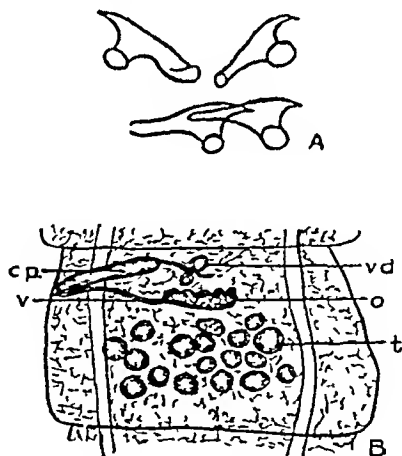


Fig 326 — *Deltoceras ornithium* A, rostellar hooks, $\times 530$, B, mature segment, $\times 47$ (After Meggitt, in 'Parasitology')

Deltoceras ornithium Meggitt, 1927 (Fig. 326.)

From *Urocissa occipitalis*, Victoria Memorial Park, Rangoon Meggitt

The worm attains a length of 4 cm and a maximum breadth of about 1.1 mm. The genital pores are unilateral and are situated at the anterior third of the lateral margin of the segment, the genital atrium is either small or absent. The rostellum is armed with 40 hooks in two rows. Each hook

measures from 27 to 31 μ in length and the hooks in both rows are alike

Male Genitalia There are 20 testes situated posteriorly and laterally to the ovary The cirrus sac measures from 140 to 200 μ by 40 μ , and extends median to the excretory vessels

Female Genitalia The ovary is sac-shaped, slightly lobed and ventrally placed Fully gravid segments have not been described, the ripe segments contain a lobed sac (the uterus) full of eggs, which occupies the position formerly occupied by the ovary and extends to the anterior margin of the segment There is no indication of even the beginning of a paruterine organ, but if one appears later on it must develop posteriorly

Genus X CYCLORCHIDA Fuhrmann, 1907

Rostellum armed with a double crown of hooks, each hook having a large dorsal root and a small blade Genital pores unilateral Genital canals pass between the longitudinal vessels Cirrus sac communicating with genital atrium by a narrow canal opening upon a large papilla Testes very numerous, entirely surrounding the female glands Uterus ventral, growing laterally between the excretory vessels into the cortical parenchyma Adults in birds and mammals

Type-species —*Cyclorchida omalancristota* (Wedl, 1856)

Cyclorchida omalancristota (Wedl, 1856) Fuhrmann, 1907.
(Figs 327 & 328)

Synonym —*Tenia omalancristota* Wedl, 1856

From a spoon-bill (*Platalea* sp.), Zoological Gardens, Calcutta Southwell

The worm attains a length of 25 cm and a breadth of 4 mm The segments are all broader than long, and their lateral margins are slightly salient The genital pores are unilateral, each one being situated on a papilla in the anterior half of the lateral margin of the segment, the pore opens into a rather long narrow genital atrium The head is large and rounded, having a breadth of about 400 μ , with powerful suckers which have a diameter of about 180 μ The short stout rostellum is armed with 20 peculiarly shaped hooks arranged in a double row The hooks in the anterior row have a length of 170 μ , and those in the posterior are about 60 μ

The longitudinal muscles consist of two layers of bundles, the inner one being much larger than the outer Internal to the longitudinal muscles there is a well developed circular layer of fibres

The excretory system consists of two vessels on each side, a large ventral vessel and a small dorsal one, lateral to which is a minute longitudinal nerve

The testes are very numerous (about 90), and entirely surround the female genitalia. The vas deferens is very coiled and, together with the vagina, passes between the longitudinal excretory vessels. The cirrus sac is very long, viz., about 200μ ,

Fig 327

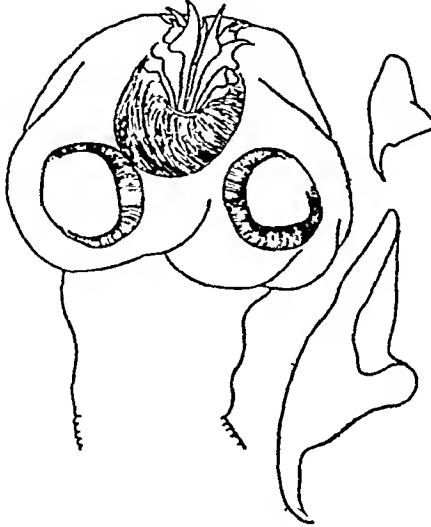
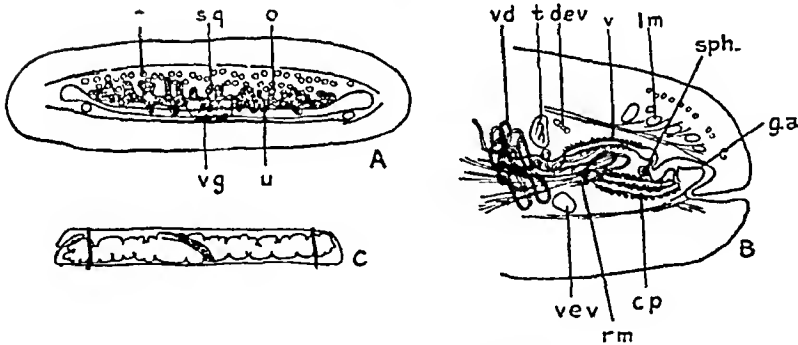


Fig 328



Cyclorchida omalancristota

Fig 327 —Head, $\times 53$, and rostellar hooks, $\times 200$ (Original)

Fig 328 —A, transverse section of mature segment, B, transverse section of poral half of segment, showing arrangement of genital ducts, C gravid segment. Magnification unknown (After Fuhrmann).

and extends median to the longitudinal excretory vessels, it is almost a third the breadth of the segment.

The ovary is large, broad, short antero-posteriorly, and bilobed, it has a breadth of about 570μ and occupies the middle half of the segment, each lobe consists of a number of short tubes extending dorsally and ventrally. The vagina runs posteriorly to the cirrus sac and the walls of its terminal

part are glandular. It dilates into a long fusiform receptaculum seminis. The vitelline gland is large, reniform, and situated posteriorly to the ovary, a small yolk reservoir lies in its concavity, whilst antero-dorsally to it is the small shell gland. The uterus is at first a narrow transverse tube which eventually widens and extends between, and lateral to, the excretory vessels when fully gravid it entirely fills the segment, and its cavity is divided up into compartments by ingrowths from its wall. The oncosphere measures $24\ \mu$.

Subfamily II DIPYLIDIINÆ Stiles, 1896

Rostellum armed (except in *Eugonodæum*) Suckers unarmed. A single or double set of reproductive organs in each segment. Uterus sac-like, reticulated, simple or lobed, breaking down into numerous egg-capsules, each containing one or several eggs. Paruterine organs absent. Adults in birds, mammals, and fishes.

Type-genus — *Dipylidium* Leuckart, 1863

Key to Genera

- | | |
|--|-------------------------------|
| 1 Genitalia single | 2 |
| Genitalia double | <i>DIPYLIDIUM</i> , p 175 |
| 2 Rostellum armed with a single row of hooks | 3 |
| Rostellum armed with a double row of hooks | 4 |
| 3 Genital pores unilateral | <i>MAIURA</i> , p 183 |
| Genital pores irregularly alternate | <i>PROCHOALOTÆNIA</i> , p 181 |
| 4 Genital pores unilateral | <i>SOUTHWELLIA</i> , p 180 |
| Genital pores irregularly alternate | <i>MONOPYLIDIUM</i> , p 178 |

Genus I *DIPYLIDIUM* Leuckart, 1863

Synonym — *Cryptocystis* Villot, 1882

Rostellum armed with several circlets of hooks which are usually rose-thorn-shaped and provided with a discoidal base. A double set of reproductive organs in each segment. Testes numerous, scattered throughout the entire medullary parenchyma. Uterus at first reticulate, later breaking up into egg-capsules, each containing one or more eggs. Adults in birds and mammals, larval stages in insects and reptiles.

Type-species — *Dipylidium caninum* (Linnaeus, 1758)

Key to Species

- | | |
|---|-------------------------------|
| 1. Egg-capsules each contain many eggs | 2 |
| Egg-capsules each contain one egg | <i>D gervaisi</i> , p 177 |
| 2 Rostellum armed with from two to five rows of hooks, eggs $50\ \mu$ | <i>D caninum</i> , p 176 |
| Rostellum armed with six or seven rows of hooks, eggs $25\ \mu$ | <i>D sercoronatum</i> , p 178 |

segments are longer than broad (7 mm by 2 to 3 mm) and each segment has two genital pores, one on each lateral margin.

The head is very small and has a club-shaped rostellum armed with from two to five rings of very small rose-thorn-shaped hooks. Those in the anterior ring are the largest (11 to 15μ), whilst those in the posterior ring are smaller (6μ).

Each segment contains a double set of genital organs, one on each side. Another peculiar feature of the anatomy of this worm is the fact that the testes lie in a reticulum, one testis in each reticular space. As the testes disappear after functioning, each space, previously occupied by a testis, comes to contain a capsule in which there are from 5 to 20 eggs—that is to say, the uterus is reticular and the eggs are in capsules. The egg measures about 50μ in diameter and is remarkably similar to the egg of *Hymenolepis nana* and *Hymenolepis diminuta*. The oncosphere measures from 25 to 36μ in diameter. In this respect it differs from the egg of *H. nana*, in which the oncosphere only measures about 18μ . The oncosphere of *H. diminuta* is about the same size as that of *Dipylidium caninum*, but in *H. diminuta* the egg-shell is thick, whilst in *D. caninum* it is thin.

The eggs, when swallowed by, say, the larvæ of the dog louse, or flea, etc., develop into cysticercoids, which during the metamorphosis of these larvæ eventually come to lie in the body-cavity of the adult flea or louse. They are transferred to the dog's mouth and swallowed as a result of its biting or licking these external parasites. In the dog's alimentary canal the cysticercoid develops into the adult worm.

It is doubtful whether the following species can be differentiated from *D. caninum*, viz.—*D. walkeri* Sondhi, 1925, *D. crassum* Millzner, 1926, *D. compactum* Millzner, 1926, *D. gracile* Millzner, 1926, *D. longulum* Millzner, 1926, *D. diffusum* Millzner, 1926, *D. cerleyi* Ratz, 1900, *D. quinque-coronatum* Lopez-Neyra and Medina, 1921.

(2) *Dipylidium gervaisi* Setti, 1895

From (1) *Felis viverrina*, Zoological Gardens, Calcutta Southwell. (2) The Malayan palm-civet (*Paradoxurus hermaphroditicus*), Zoological Gardens, Calcutta Southwell.

The worm measures from 1 to 4 cm in length and has a maximum breadth of 1 mm. The scolex is not sharply divided from the neck, from the rostellum to the posterior margin of the suckers it measures 150μ and its maximum breadth is 250μ , the rostellum is small and bears from eight to twelve rows of hooks. The excretory vessels are large. The egg-capsules contain each a single egg.

(3) *Dipylidium sexcoronatum* Ratz, 1900

From dogs, Punjab Sondhi

The worm measures up to 30 cm in length and has a maximum breadth of 2 mm. The scolex has a diameter of from 340 to 380 μ and a breadth of from 240 to 380 μ . The rostellum has a length of 65 μ and a breadth of 115 μ , it is armed with six, occasionally seven, rows of hooks. The egg-capsules sometimes extend laterally to the excretory vessels, each capsule containing from 2 to 15 eggs. The egg has a diameter of 25 μ .

Dipylidium sp. Gaiger (1915) records a worm from a dog, Lahore, which he doubtfully refers to the above genus.

Genus II *MONOPYLIDIUM* Fuhrmann, 1899

Rostellum with a double crown of hooks. Genital ducts pass between, or dorsally to, the longitudinal excretory vessels. A single set of reproductive organs in each segment. Testes numerous, posterior. Uterus much branched, breaking down into egg-capsules which usually contain each a single egg. Adults in birds.

Type-species — *Monopylidium musculosum* (Fuhrmann, 1896)

The following table shows the close relationship between the genera detailed below. It will be noted that the genus *Choanotænia* Railliet, 1896, has a persistent uterus, whilst in the remaining three genera the uterus breaks up into egg-capsules. The former genus is accordingly placed in the subfamily Dilepidinæ Fuhrmann, 1907, whilst the latter three genera are included in the *Dipylidinæ* Stiles, 1896. Attention has been called elsewhere to the fact that the three genera *Amæbotænia* Cohn, 1899, *Anomotænia* Cohn, 1900, and *Choanotænia* Railliet, 1896, are very closely related (see page 159) —

	<i>Choanotænia</i> Railliet, 1896	<i>Monopylidium</i> Fuhrmann, 1899	<i>Prochoanotænia</i> Meigitt, 1924 = <i>Choanotænia</i> Lühe, 1910	<i>Southicella</i> Moghe, 1925
Rows of hooks on rostellum	Single	Double	Single	Double
Genital pores	Irregularly alternate	Irregularly alternate	Irregularly alternate	Unilateral
Uterus	Persistent	Resolves into capsules, one egg in each	Resolves into capsules, one egg in each	Resolves into capsules, 5 to 9 eggs in each

Monopylidium chandleri Moghe, 1925 (Fig 330)

From *Sarcogammus indicus*, Nagpur, Central Provinces Moghe

The worm attains a length of 7 cm and a maximum breadth of 3.3 mm, it is composed of about 135 segments, all of which are broader than long. The genital pores are irregularly alternate and are situated a little anterior to the middle of the lateral margin of the segment. The neck measures from 2 to 2.5 mm in length. The scolex, which is not distinctly set off from the neck, has a diameter of $920\ \mu$. The rostellum is large, muscular, and conical, terminating in a rounded knob, it measures about $517\ \mu$ in length and has a maximum breadth of about $320\ \mu$. It is armed with 20 hooks, which alternate with each other, but whether they are in a single row or a double row is largely a matter of opinion. All the hooks are of the same size and shape and measure about $117\ \mu$ in length.

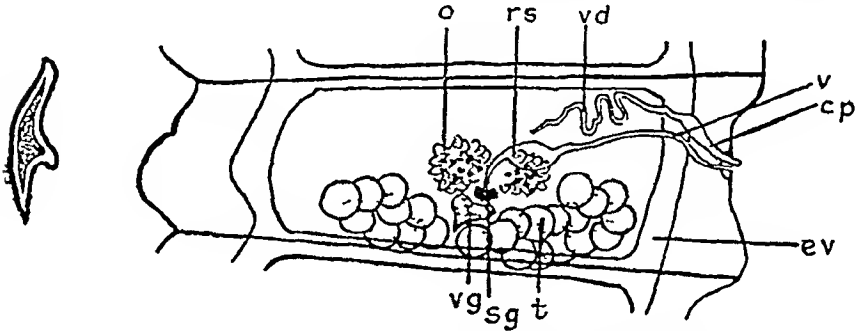


Fig 330 — *Monopylidium chandleri*. Rostellar hook, $\times 160$, mature segment, $\times 45$ (After Moghe, in 'Parasitology')

Male Genitalia There are from 20 to 24 testes situated posterior to the ovary, except a few on the poral side which are lateral to it. The vas deferens is a loosely coiled tube situated anteriorly. The cirrus sac measures about $176\ \mu$ in length.

Female Genitalia The ovary is situated centrally and is bilobed. The vitelline gland is small and placed immediately behind the middle of the ovary. The shell gland is a small organ between the vitelline gland and the ovary. The vagina is a straight tube situated posteriorly to the vas deferens, near the poral ovarian lobe it dilates into an oval receptaculum seminis which measures about 117 by $75\ \mu$. The uterus splits up into egg-capsules each segment containing from 140 to 165. Each capsule contains a single spherical egg having a diameter of $82\ \mu$. The oncosphere measures $48\ \mu$.

Moghe (1925) proposed the new subgenus *Macracanthus* to accommodate three species of *Monopylidium*, viz, *M. stercorarium* Baylis, 1919, *M. macracanthum* Fuhrmann, 1908,

and *M. chandleri* Moghe, 1925, in all of which the head bears a small number of very large hooks, whilst in the remaining species of the genus the hooks are more numerous and smaller. The erection of this subgenus, depending, as it does, merely on the size of hooks, appears wholly unjustifiable.

Genus III **SOUTHWELLIA** Moghe, 1925

Synonym — *Monopylidium* Southwell, 1921

Hooks very numerous (120) and of large size (about $90\ \mu$), arranged in two rows, rostellum small and bluntly pointed. Genital pores unilateral, situated in the extreme anterior corner of the segment. Cirrus sac large and muscular, genital atrium present, testes of small size situated lateral to and in front of the ovary, uterus breaks down into egg-capsules each containing from five to nine eggs.

Type-species — *Southwellia gallinarum* (Southwell, 1921)

Moghe (1925) erected this genus to accommodate *Monopylidium gallinarum* Southwell, 1921, a species which differed from all other species of *Monopylidium* in the following combination of characters —

Hooks very numerous (120), of large size ($90\ \mu$), small sized testes ($35\ \mu$ in diameter), some of which are situated in front of the ovary, unilateral genital pores, situated at the extreme anterior corners of the segments, and in the fact that there are from five to nine eggs in each capsule.

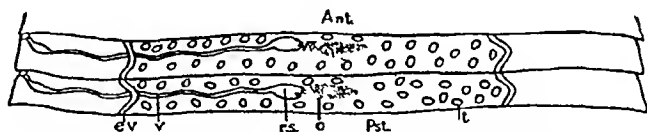


Fig 331 — *Southwellia gallinarum*. Horizontal section of mature segments, $\times 33$ (After Southwell)

Southwellia gallinarum (Southwell, 1921) (Fig 331)

Synonym — *Monopylidium gallinarum* Southwell, 1921

From the domestic fowl, Berhampur, Bengal. Southwell. The worm attains a length of 2.1 cm and a breadth of 2.5 mm. All the segments are broader than long, and even the posterior ones are very short. The segments number about 130. The genital pores are unilateral and situated at the extreme anterior corner of the segment. The head is prominent and measures about $300\ \mu$ in length by $500\ \mu$ in breadth. The rostellum is retracted and appears as a small bluntly pointed projection, armed with about 120 hooks, each measuring

about $90\ \mu$ and arranged in two rows. The suckers are large, conspicuous, and unarmed. There is no neck.

The outer longitudinal muscular layer consists of a large number of separate dorsal and ventral strands. The lateral water vessels are large and clearly seen, both in the entire worm and in sections.

There are about 30 globular testes, each measuring about $35\ \mu$, and they are situated for the most part on each side of the ovary, although a few lie in front of it. The cirrus sac is large and muscular, and the genital atrium runs anteriorly.

The ovary is situated in the middle of the segment, slightly posterior and median to the receptaculum seminis, it measures about $60\ \mu$ in length and $225\ \mu$ in breadth. A receptaculum seminis lies on the pore side of the ovary and measures about $45\ \mu$ by $15\ \mu$. There are from five to nine eggs in each capsule. The outer egg-envelope measures about $35\ \mu$ and the oncospheres about $25\ \mu$.

Genus IV PROCHOANOTÆNIA Meggitt, 1924.

Synonym — *Choanotænia* Luhe, 1910

Rostellum armed with a single crown of hooks. Genital pores irregularly alternate. Genital ducts pass between the longitudinal excretory vessels. Vesicula seminalis absent, replaced by coils of vas deferens. Testes numerous, posterior to female glands. Uterus branched, breaking down into egg-capsules, each of which usually contains a single egg. Adults in birds.

Type-species — *Prochoanotænia marchali* (Mola, 1907)

Prochoanotænia microstoma (Southwell, 1922) (Figs 332 & 333)

From (1) The eastern baya (*Ploceus atrigula*), and (2) the crested bunting (*Melophus melanicterus*), Zoological Gardens, Calcutta. Southwell.

The worm measures from 4 to 8 mm in length and has a maximum breadth of about $630\ \mu$. It consists of from 25 to about 50 segments. All the segments are broader than long. The genital pores, which are large and prominent, are irregularly alternate and are situated at the extreme anterior angle of the segment. The head is square and measures $220\ \mu$, the suckers have a diameter of $140\ \mu$. The rostellum measures about $180\ \mu$ in length and $50\ \mu$ in breadth, its anterior extremity is expanded and has a length of about $40\ \mu$ and a breadth of $90\ \mu$. It is armed with a single row of from 16 to 20 hooks each of which measures about $35\ \mu$. There is no neck.

As the material was not sufficiently well preserved, details of the muscular, excretory, and nervous systems are not known.

There are from 16 to 20 testes situated posteriorly to the ovary. When fully mature they have a diameter of about 36μ . The cirrus sac is short and narrow, extending to the water vessel to which it is dorsal, it lies anterior to the vagina. The cirrus is remarkable in having its extreme tip armed with short spines set at right angles to its length. Immediately median to the tip, it is armed with a number of hooks of a different shape which measure 30μ in length, and which lie parallel to its length. The vas deferens dilates close to the median extremity of the cirrus sac into a small seminal vesicle,

Fig 332

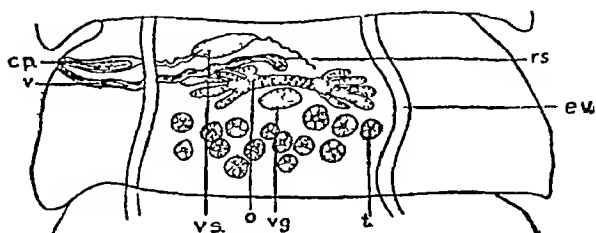
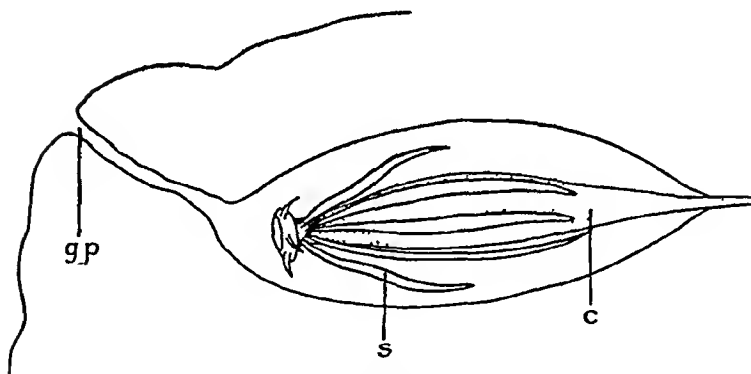


Fig 333



Prochoanotanna microsoma

Fig 332 — Mature segment, $\times 153$ (After Southwell)

Fig 333 — Showing spinous cirrus, $\times 750$ (After Southwell)

and then continues in the median direction as a very fine tube

The ovary lies quite anteriorly and is divided into two sets of acini, one on each side, widely separated from each other. The vagina is a wide muscular tube running behind the cirrus sac and dorsally to the excretory vessel. Near the centre of the segment it dilates into a globular receptaculum seminis having a diameter of about 36μ . The vitelline gland is a compact, deeply staining organ lying posteriorly to a line joining the two wings of the ovary, it has a breadth of

about $110\ \mu$. The shell gland lies immediately anterior to the vitelline gland, it is somewhat globular and has a diameter of about $30\ \mu$. The uterus appears suddenly as a transverse sac just in front of the ovary. In the next segment the ovary and testes have entirely and as suddenly disappeared, the whole segment being occupied by egg-capsules, each containing a single egg.

Genus V MALIKA Woodland, 1929

Rostellum armed. All proglottides (save occasionally the terminal ones) considerably broader than long. Genital pores unilateral. Genital ducts pass between the excretory canals. A single set of genitalia in each segment. Ovary parol. Uterus sacciform, resolving into capsules, each containing several eggs. Adults in birds.

Malika ædicnemus Woodland, 1929 (Fig 334)

From the stone-curlew (*Ædicnemus scolopax*), near Allahabad, United Provinces. Woodland.

The worm attains a length of 6 cm and a maximum breadth of 1.6 mm. All the segments are broader than long except

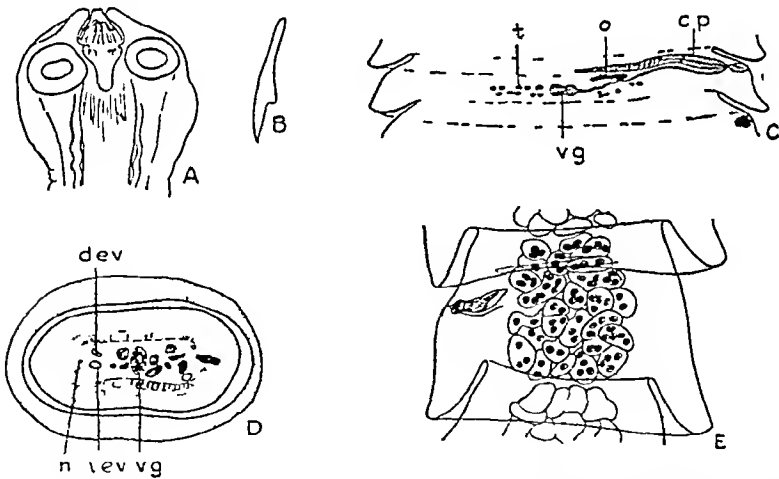


Fig 334 — *Malika ædicnemus*. A, head, $\times 37$, B, rostellar hook, $\times 107$, C, mature segment $\times 26$, D, transverse section of mature segment, $\times 19$, E, gravid segments, showing egg capsules, $\times 26$ (After Woodland, in 'Parasitology')

a few of the terminal ones. The genital pores are unilateral, on the left side, and situated a little in front of the middle of the lateral margin of the segment. The scolex measures $400\ \mu$ in length and $500\ \mu$ in breadth. The rostellum is well developed

and when retracted measures $250\ \mu$ in length, it bears a single crown of about 30 hooks, each measuring about $73\ \mu$. There is no neck.

Muscular System The longitudinal muscles consist of two layers, viz., an inner of large bundles and an outer of small ones. Between them is a thin layer of transverse fibres and a second one of transverse fibres occurs immediately internal to the inner bundles. A single layer of minute longitudinal fibres lies just beneath the cuticle.

The ventral excretory vessel is much larger than the dorsal, the longitudinal nerve is situated internally to the inner layer of longitudinal muscles.

Male Genitalia There are from 18 to 27 testes, in a transverse row, two or three layers deep and situated behind the ovary and vitelline gland. The cirrus sac is anterior to the vagina, it measures about $200\ \mu$ in length, $40\ \mu$ in breadth, and extends as far as the ventral excretory vessels, the cirrus is unarmed. Outside the sac the vas deferens forms an elongated mass of coils anteriorly to the ovary.

Female Genitalia The ovary is poral and anterior, the vitelline gland is compact, irregular in form, and situated median and posteriorly to the ovary. The vagina, at its inner extremity, dilates into a receptaculum seminis. Both the male and female genital ducts pass between the dorsal and ventral excretory vessels and dorsally to the nerve. The uterus develops a number of lateral, branched, slender diverticula with dilated extremities full of eggs, extending to the ventral excretory vessels and finally occupying the whole of the medulla. Ultimately these diverticula become separated and form closely-packed capsules each containing from 3 to 13 oncospheres which measure 62 by $22\ \mu$, the hooks measure $30\ \mu$ in length and each oncosphere is invested by a thin sheath.

Subfamily III PARUTERININÆ Ransom, 1909

Scolex armed or unarmed, rarely without rostellum. A single set of reproductive organs in each segment. Uterus single or double, with a single paruterine organ, or multiple with several paruterine organs into which the eggs pass in the final stage of development of the segment. Adults in birds.

Type-genus — *Paruterina* Fuhrmann, 1906

Key to Genera

Fully gravid uterus consists of two spherical
sacs

Fully gravid uterus tubular or globular

METROLIASTHFS, p 185.
RHABDOMFTRA, p 186

Genus I. **METROLIASTHES** Ransom, 1900.

Scolex unarmed, without rostellum. Genital pores irregularly alternate, genital canals pass between dorsal and ventral longitudinal excretory vessels. Testes 20 to 40. Uterus single in origin and consisting, when fully developed, of two spherical sacs touching in the median line and more or less fused with one another. A paruterine organ develops in front of the uterus, and finally becomes transformed into a spherical egg-capsule. Adults in birds.

Type-species — *Metroliaesthes lucida* Ransom, 1900

Metroliaesthes lucida Ransom, 1900 (Fig 335)

From the domestic fowl, Orissa. Southwell

The worm attains a length of 20 cm and a breadth of about 1.6 mm. The genital pores are situated a little behind the centre of the lateral margin of the segment. The posterior

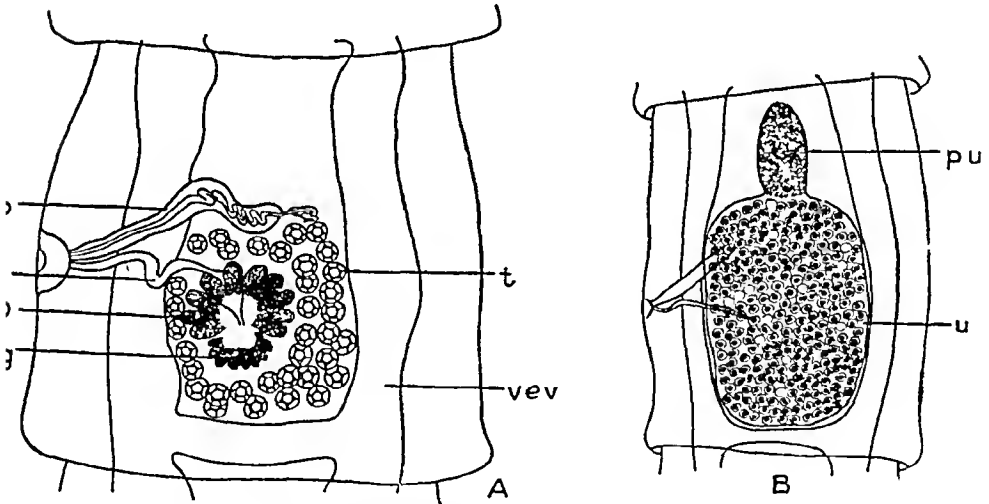


Fig 335 — *Metroliaesthes lucida*. A, mature segment, $\times 53$, B, gravid segment, $\times 27$ (Original)

segments are about twice as long as broad. The worm is rather transparent, especially the gravid segments, the posterior half of the strobila is characterized by a white spot (paruterine organ) in each segment, situated near the middle line. The head is almost spherical and measures about 600μ in length by 750μ in breadth. It bears neither hooks nor rostellum.

Muscular System The longitudinal muscle fibres are disposed in a layer consisting of two parts, namely, an inner of about

100 large bundles, and an outer of isolated bundles of from 3 to 5 fibres scattered throughout the parenchyma. The transverse muscles lie in a thin band immediately within the longitudinal muscles.

Excretory System There are two longitudinal vessels on each side, the ventral vessel being much the smaller.

Male Genitalia There are from 35 to 40 testes in young segments, the number being reduced in older segments. The cirrus sac is flask-shaped and extends about a quarter the breadth of the segment. As usual, the vas deferens forms a number of coils immediately median to the cirrus sac.

Female Genitalia The ovary is situated in the middle of the segment and is a simple sac-like organ divided into compartments. The vagina is a comparatively straight tube opening to the genital atrium just posteriorly to the cirrus, it runs towards the centre of the segment and then dilates into the receptaculum seminis. The vitelline gland lies posteriorly to the ovary and is, like the ovary, a sacculated structure. The shell gland is a small oval body lying between the vitelline gland and the ovary. The uterus at first is a transverse band of cells lying dorsally and slightly posteriorly to the ovary. Later on it occupies practically the whole of the segment behind the pore and bulges out the wall of the segment dorsally and ventrally. Shortly after eggs have appeared in the uterus modifications take place. Immediately in front of the uterus, within a cone-shaped area, the parenchyma becomes spongy and greatly thickened fibres develop. The latter eventually form a surrounding wall. This structure finally becomes the prominent paruterine organ, mentioned above, into which eggs from the uterus pass. The egg measures 75 by 50 μ and the oncosphere 30 μ .

Genus II RHABDOMETRA Cholodkovsky, 1906

Scolex unarmed, without rostellum. Genital pores irregularly alternate. Genital canals pass between the longitudinal excretory vessels. Testes posterior and lateral to female glands. Uterus median, tubular, and elongated longitudinally, or globular, a paruterine organ develops anteriorly to the uterus and extends forward nearly to the anterior border of the segments. Adults in birds.

Type-species — *Rhabdometra tomica* Cholodkovsky, 1906

Key to Species

- | | |
|---|------------------------------|
| With 10 to 12 testes, longitudinal musculature
in two layers | <i>R dendrocitta</i> , p 188 |
| With 20 to 30 testes, longitudinal musculature
in a single layer | <i>R tomica</i> , p-187 |

(1) *Rhabdometra tomica* Cholodkovski, 1906 (Fig 336)

From the painted partridge (*Francolinus pictus*), Zoological Gardens, Calcutta Southwell

The worm attains a length of about 7 cm and a breadth of 1.5 mm. The posterior segments are longer than broad, measuring about 2.1 mm in length and $900\ \mu$ in breadth, their posterior margins are bell-like in outline. The genital pores are irregularly alternate and situated a little in front of the middle of the lateral margin of the segment. The head is unarmed and without a rostellum, it has a length of $400\ \mu$ and a breadth of $540\ \mu$. The suckers are prominent, there is no neck.

The longitudinal muscles are well developed and consist of a single layer of bundles which decrease in size externally. The

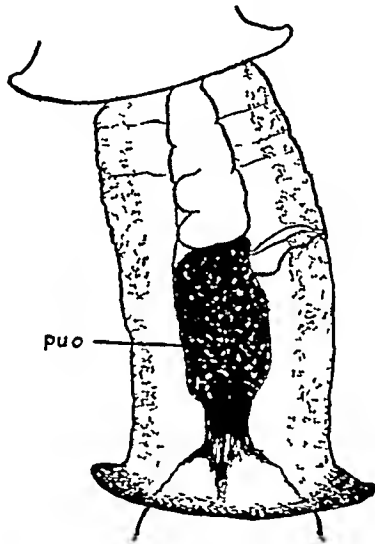


Fig 336 —*Rhabdometra tomica* Gravid segment, $\times 16$
(Original)

circular muscles are also well developed, they lie immediately internal to the longitudinal bundles and have a thickness of $9\ \mu$. The cuticle has a thickness of $5\ \mu$. The dorsal excretory vessel on each side is extremely small and difficult to see, whilst the ventral vessel is very large and situated laterally. The ventral vessels communicate with each other by a wide canal in the posterior part of each segment. The genital ducts pass between the excretory vessels.

There are from 20 to 30 testes, situated in a group, in the posterior part of the segment, behind the female organs, and extending laterally and anteriorly to the ovary. The cirrus.

sac is rather large and extends slightly median to the ventral excretory vessel. The vas deferens is much coiled and runs towards the anterior median part of the segment.

The ovary is large and globular, situated in the posterior part of the segment, immediately behind it is the somewhat U-shaped vitelline gland. The vagina lies posteriorly to the cirrus sac and is a rather wide tube pursuing a curved course to the ovarian region, where it dilates into a small receptaculum seminis. The uterus arises in front of the ovary as a rather wide tube running antero-posteriorly, a paruterine organ develops in front of the uterus and extends in the median direction to the anterior border of the segment. The egg is oval and has a length of about $40\ \mu$.

(2) *Rhabdometra dendrocitta* Woodland, 1929 (Fig 337)

From *Dendrocitta rufa*, Allahabad, India. Woodland

The worm varies in length from 4 to 6 cm and has a maximum breadth of 1 mm. Gravid segments may be twice

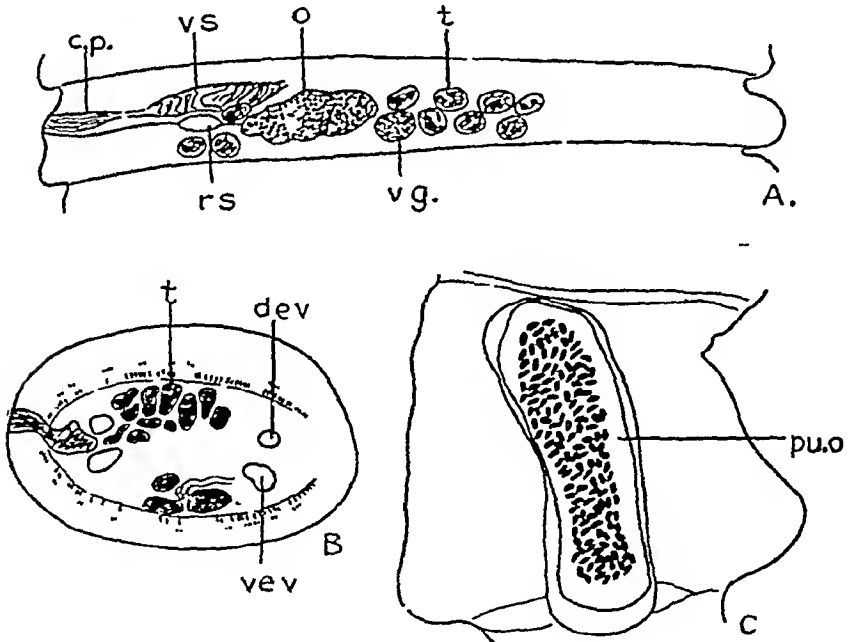


Fig 337—*Rhabdometra dendrocitta* A, mature segment, $\times 56$, B, transverse section of mature segment, $\times 56$, C, gravid segment, $\times 39$ (After Woodland, in 'P Z S')

as long as broad with the posterior margin expanded. The genital pores are irregularly alternate and are situated towards the anterior extremity of the lateral margin of the segment.

The genital ducts pass between the dorsal and ventral excretory vessels and ventral to the nerve. The scolex is very short, broader than the succeeding neck region, and measures about $20\ \mu$ in length and 600 to $800\ \mu$ in breadth. There is no rostellum and the head is entirely unarmed, a neck is absent.

The longitudinal muscles are in two layers of bundles, external to which is a very thin layer of transverse fibres.

The ventral excretory vessels are larger than the dorsal and the former are in communication in the posterior part of the segment.

Male Genitalia There from 10 to 12 testes, situated dorsally in a median group. The cirrus sac is small, measuring $160\ \mu$ in length, and opens anteriorly to the vagina into a small genital atrium. The vas deferens forms a conspicuous mass of coils surrounding a large retractor muscle.

Female Genitalia The ovary at first is large, sac-shaped and situated slightly porally, later on it becomes an ovoid sac with a limiting wall, and this is the uterus of gravid segments, i.e., the ovary becomes transformed into the uterus. At its aporal extremity there is a spherical vitelline gland which gradually disintegrates. A shell gland could not be detected. The vagina is a narrow tube which dilates near the middle of the segment into a small receptaculum seminis. The paruterine organ develops from the poral end of the uterus, it finally appears as a spherical sac projecting beyond the posterior border of the segment, and eggs are liberated by the bursting of this sac. The ripe eggs contain elongated embryos which measure about $55\ \mu$ in length, $9\ \mu$ in breadth, and are pointed at both ends.

Family VI. MESOCESTOIDIDÆ Fuhrmann, 1907.

Scolex without rostellum or hooks. Suckers unarmed. A single set of reproductive organs in each segment. Genital pores on ventral surface of segment, median. Eggs in gravid segments enclosed in a single thick-walled capsule. Adults in birds and mammals.

Type-genus — *Mesocestoides* Vaillant, 1863

Genus **MESOCESTOIDES** Vaillant, 1863

Synonyms — *Monodoidium* Walter, 1866
Ptychophysa Hamann, 1835

With characters of the family

Type-species — *Mesocestoides ambiguus* Vaillant, 1863

Key to Species

- Testes extending laterally to excretory vessels . *M lineatus*, p 190
 Testes not extending laterally to excretory vessels . *M mesorchis*, p 192.

(1) *Mesocestoides lineatus* (Goeze, 1782) Railliet, 1893. (Fig. 338)

Synonyms — *Tænia lineatu* Goeze, 1782
Halysis lineata (Goeze, 1782) Zeder, 1803
Tænia canis lagopodis Rudolphi, 1810
Tænia pseudoelliptica Baillet, 1863
Tænia pseudo-cucumerina Baillet, 1863
Ptychophysa lineata (Goeze, 1782) Hamann, 1885
[?]*Mesocestoides litteratus* (Batsch, 1786) Dolley, 1894

Apparently the species cannot be differentiated from *M litteratus* (Batsch, 1786) Dolley, 1894

From (1) *Felis tigris*, Zoological Gardens, Calcutta Southwell (2) Dogs, Civil Veterinary Department, Lahore, Punjab

The worms measure from 30 cm to 2.5 m in length and have a maximum breadth of about 3 mm. The terminal segments are much longer than broad and frequently measure 5 mm in length and about 2 or 3 mm in breadth. The genital pores are situated on the ventral surface near the middle. In fresh specimens the strobila sometimes shows a light reddish colour along the longitudinal axis. The head measures about 700 μ in diameter, there is no rostellum, but in its place there is a slight terminal depression. The neck is very short.

Male Genitalia There are about 50 large testes scattered throughout the segment and extending laterally to the longitudinal excretory vessels. From the mid-dorsal line to the anterior extremity of the segment the vas deferens is thrown into a number of coils, anteriorly it turns sharply and runs to the cirrus sac, which is situated in the anterior part of the segment. The cirrus sac is very prominent and pyriform, the pore lies irregularly a little to the right or a little to the left of the median line. The cirrus may measure up to 1 mm in length and it has a dilated base.

Female Genitalia The ovary is bilobed and is situated in the posterior quarter of the segment. The bilobed vitelline gland lies partly posterior and partly ventral to the ovary. The vagina does not bear a receptaculum seminis. The uterus consists of an elongated cylindrical sac in the median longitudinal axis of the segment. Its anterior part presents a curve on one side and in this concavity the cirrus sac always lies. The posterior part of the uterus dilates and becomes trans-

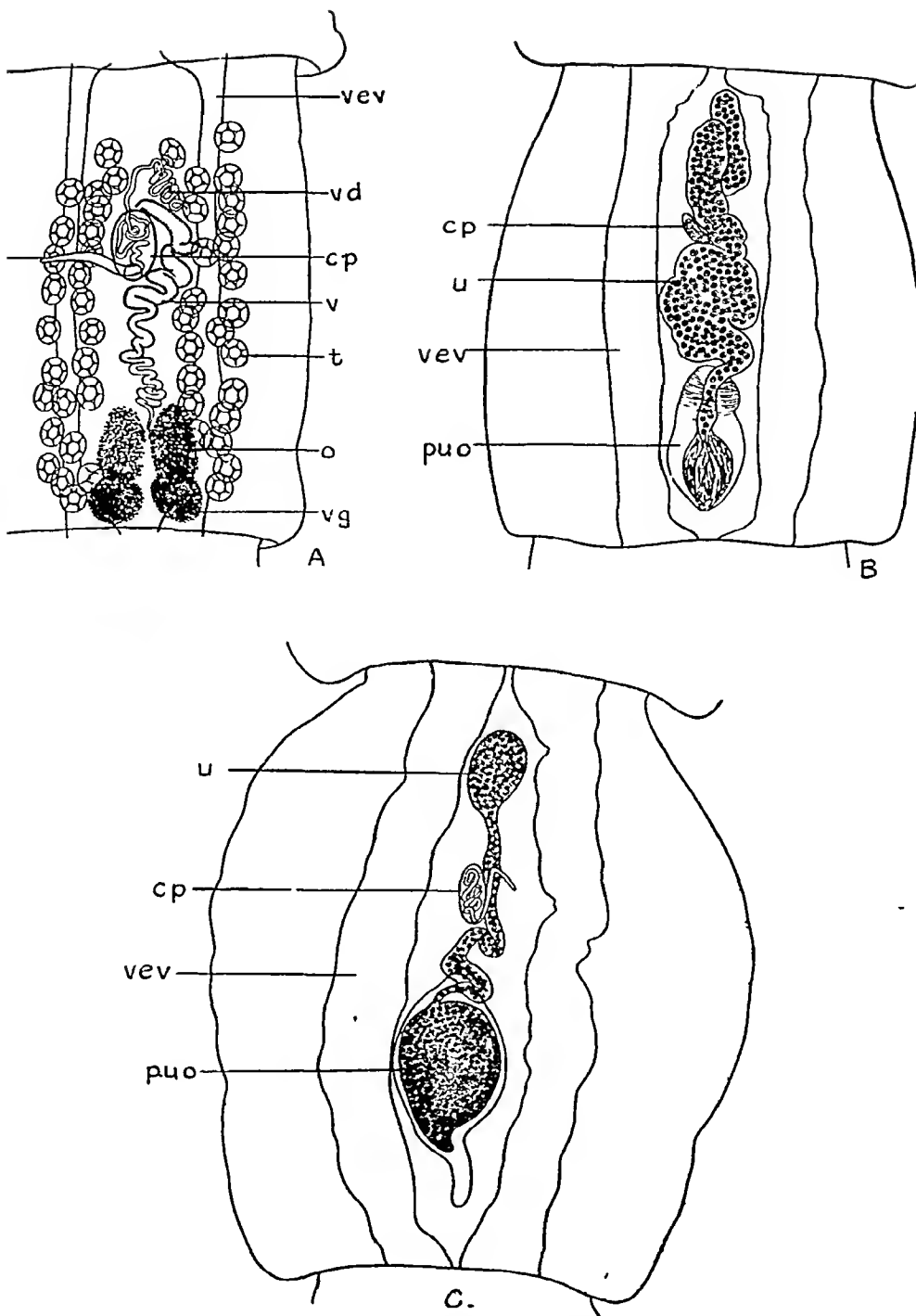


Fig-338 —*Mesocestoides lineatus* A, mature segment, $\times 53$, B, gravid segment, showing fully expanded uterus, $\times 27$, C, gravid segment, showing fully expanded paruterine organ, $\times 27$ (Original)

formed into an egg-capsule, the remaining part of the uterus persisting as a cord-like structure. The egg measures from 40 to 60 μ in length and about 35 to 43 μ in breadth.

(2) *Mesocestoides mesorchis* Cameron, 1925

From the Tibetan fox (*Vulpes ferrilatus*)

The worms attain a length of 75 cm and a maximum breadth of 1 mm. The gravid segments assume the form of cucumber seeds, mature segments are more rectangular, and the immature segments are broader than long. The margin of the strobila is smooth. Calcareous corpuscles are abundant, and, unless the parasite is fixed in an acid medium, they almost obscure the genital organs in stained segments. The genital pore is situated on the flat side (ventral), slightly in front of the middle. The scolex has a diameter of about 500 μ and is unarmed. The suckers have a diameter of 200 μ , they are very muscular and their cuticular lining is thrown into a large number of minute irregular projections. The musculature of the suckers is not complete posteriorly. The neck has a length of about 1 mm.

The musculature consists of a rather thick layer of longitudinal bundles limited internally by a thin layer of transverse muscles.

— The excretory system consists of two longitudinal vessels on each side, the outer vessel is small and disappears in mature segments, and the inner vessel increases in size, becoming large and conspicuous, the latter are in communication with each other by a large transverse vessel situated near the posterior margin of each segment.

There are about 50 testes in each segment and they are confined to the space between the large longitudinal canals; in this point the worm differs from *M. lineatus*. The cirrus sac is almost spherical and has a diameter of about 150 μ . Along with the vagina it opens into a flat discoid atrium, which opens to the exterior by a pore. The cirrus is long and capable of extending to the margin of the segment.

The ovary is strongly bilobed as in the genus *Tænia*, it is situated posteriorly and lies dorsally to the vitelline gland. The latter organ is composed of two spherical structures usually situated near the centre of the ovary. A small shell gland surrounds the oviduct at the point where it joins the uterus. The vagina is a very long convoluted tube three times the length of the segment. The uterus is a thin walled tube arising at the level of the anterior margin of the ovary, it passes lateral to the central vagina and cirrus, runs anteriorly, where it ends blindly, there being no uterine pore. A globular paruterine organ develops in gravid segments in

the posterior third of the uterus, and into this structure the eggs pass

The species apparently differs from *M. lineatus* in that the testes do not extend laterally to the excretory vessels

DITHYRIDIUM Rudolphi, 1819 (*Piestocystis* Diesing, 1850)

This name is applied to those larval cestodes which possess a solid body without caudal bladder and which are more or less elongated. The scolex (which is unarmed) is invaginated into the body and bears four suckers. They are believed to be larval forms of species of the genus *Mesocoeloides*

Meggitt (1927) records the following species from Burma

(a) **DITHYRIDIUM** sp. I From *Rhabdophis stolatus*. Common in the intestinal wall and mesentery, the cysts having a diameter of from $700\ \mu$ to 1.2 mm. The larva, when extended, measures 2 mm. by 1 mm. and is solid, it has no distinct head, no armature, and no invaginations. One extremity bears four feeble suckers, the parenchyma contains numerous calcareous corpuscles

(b) **DITHYRIDIUM** sp. II From *Dichoceros bicornis*. The cysts occur in the liver, each one having a maximum diameter of about 3 mm. The larvæ are devoid of scolex and armature, but at one end there is an invagination terminating in four suckers, whilst at the other end there exists a small pore leading into small narrow chambers

(c) **DITHYRIDIUM** sp. III From *Ophites jara*

(d) **DITHYRIDIUM** sp. IV From *Bungarus multicinctus*. A single specimen from the intestinal wall

(e) **DITHYRIDIUM** sp. V From *Oligodon purpureus*

Family VII NEMATOTÆNIIDÆ Luhe, 1910

Strobila cylindrical. Scolex unarmed, without rostellum. External segmentation incomplete, only corresponding with internal posteriorly. A single set of reproductive organs in each proglottis. Cirrus and vagina open near one another into an alternating genital atrium whose marginal position is only recognizable from the course of the longitudinal nerve and excretory system. Genital ducts pass dorsally to longitudinal excretory vessels and nerve. Testes one or two, dorsal. Ovary and vitelline glands ventral, the latter dorsal to the former. Uterus breaks down early, the eggs subsequently becoming enclosed in paruterine capsules. Adults in amphibians

Type-genus — *Nematotænia* Luhe, 1899

Genus **NEMATOTÆNIA** Luhe, 1899

Testes two, dorsal Ovary ventral, slightly poral Uterus horse-shoe-shaped, disappearing early, as a result of the development of numerous paruterine organs, the eggs become enclosed in from 13 to 30 egg capsules, each containing three or four eggs, which are scattered throughout the proglottis Adults in amphibia

Type-species —*Nematotænia dispar* (Goeze, 1782)

? *Nematotænia dispar* (Goeze, 1782) Luhe, 1899

Synonym —*Tænia dispar* Goeze, 1782

From (1) *Bufo melanostictus*, India Southwell (2) *Bufo* sp., Lucknow, India Southwell

A few fragments with one damaged scolex were referred by Southwell, with considerable hesitation, to the above species The largest fragment measured 7 mm in length, the anterior extremity being unsegmented The worms were circular in cross-section, no details of the internal anatomy could be determined

Family VIII **AMABILIIDÆ** Fuhrmann, 1908.

Scolex with armed rostellum, suckers unarmed Proglottides with lateral appendages A double or single set of reproductive organs in each proglottis Male genital pores marginal Vaginal pore absent, replaced by the marginal, ventral, or dorsal opening—never near the male pore—or by an accessory canal Adults in birds

Type-genus —*Amabilia* Diamare, 1893

Genus **AMABILIA** Diamare, 1893

Synonym —*Aphanobothrium* Linstow, 1906

Scolex small, with armed rostellum A double set of male reproductive organs in each proglottis Cirrus armed with strong spines Testes numerous, median Female organs single in each proglottis, median Accessory vagina opening ventrally, communicating (?) with a canal from the excretory system Uterus a cage-like meshwork

Type-species —*Amabilia lamelligera* (Owen, 1835)

Amabilia lamelligera (Owen, 1832, ? 1835) Diamare, 1893
(Fig. 439)

Synonyms — *Tænia lamelligera* Owen, 1832

Amabilia lamelligera (Owen, 1832) Diamare, 1893

Aphanobothrium catenatum Linstow, 1906

Amabilia catenata (Linstow, 1906) Fuhrmann, 1908

From the flamingo (*Phænicopterus roseus*), Welgatta, Ceylon
? Willey

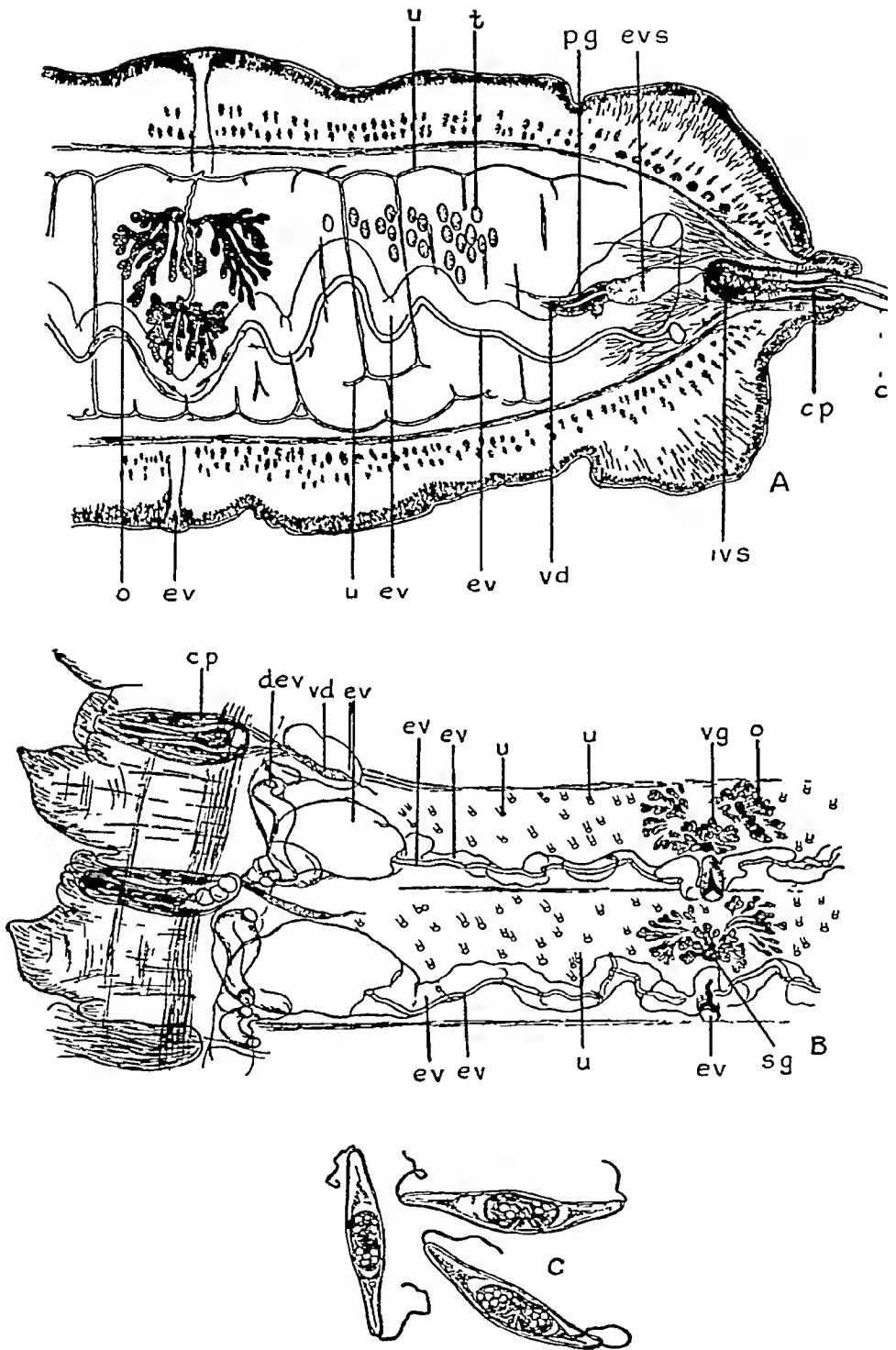


Fig 339 — *Amabilta lamelligera* A, transverse section of mature segment, B, horizontal section of mature segment, C, eggs Magnification unknown (After Clausen)

The worm attains a length of 14 cm and a breadth of from 9 to 10 mm. The strobila is attenuated anteriorly and truncated posteriorly, it has a thickness of about 4 mm. The segments are broader than long, those in the middle and posterior part of the body having a length of 1 mm. The posterior lateral corners are salient. The genital pores are double and are situated at the extreme anterior corner of the lateral margin of the segment. Each of the latter contains a double set of male and a single set of female organs. The genital pore consists of only the opening of the vas deferens. There are two accessory vaginae, one opening dorsally and the other ventrally, apparently they communicate with a canal from the excretory system.

The scolex is very small and bears anteriorly a minute retractile rostellum, no mention of hooks is made by either Linstow or Clausen.

Muscular System This is strongly developed, the longitudinal muscles consist of two or three layers of bundles, the internal layer being most pronounced. The transverse muscles are also well developed, and are situated internally to the longitudinal muscles.

The ventral excretory vessels are large and thin-walled, whilst the dorsal ones are small and thick-walled.

Male Genitalia These are double in each segment. There are about 200 testes, about half of which are in communication with the cirrus on one side, the other half being in communication with the cirrus on the other side of the segment. They are disposed in several layers dorso-ventrally and develop rapidly, they also disappear very suddenly, so that when the rudiments of the uterus become visible they have entirely degenerated. The vas deferens runs from the vicinity of the uterus to the cirrus sac in a straight or slightly undulating course. The part immediately internal to the cirrus sac is surrounded by prostatic cells. An external seminal vesicle is present. Inside the cirrus sac the vas dilates into an internal seminal vesicle with thick muscular walls, which entirely fills the sac. The cirrus and the internal seminal vesicle are surrounded by unicellular (? prostatic) glands. The cirrus is armed with a large number of closely set spines measuring 10μ , each of which has a broad base, it is also furnished with a retractor muscle. The cirrus sac is very muscular and opens to a genital atrium situated on a large, prominent, conical papilla. The vas deferens passes between the excretory vessels and dorsally to the nerve.

Female Genitalia The ovary is ventral and situated close to the anterior border of the segment, it consists of two wings. It has a transverse diameter of 1.5 mm and a dorso-ventral diameter of 1.1 mm. Each wing consists of a number of digitiform lobes arranged fan-wise. The vitelline gland lies

dorsally and posteriorly to the ovary and measures from 660 to 760 μ transversely and 57 μ dorso-ventrally. The shell gland is large and measures 280 μ in diameter, it is situated in the median line between the two lobes of the ovary just anterior to the vitelline gland. Contrary to what occurs in other cestodes, the relatively small vagina in this species is stated by Clausen to open not into the genital atrium, but into a canal from the excretory system which discharges on the ventral surface of the segment in the median line. A large receptaculum seminis is present, which also, according to Clausen, opens into the dorso-ventral canal just dorsal to the vitelline gland. The uterus is a very curious structure, consisting of a loose network of canals which at first are very narrow. The two systems of canals, i. e., uterine and excretory, round which calcareous corpuscles are particularly numerous, communicate with each other by numerous dorso-ventral canals, each one of which may be bifurcated. The egg has three membranes, the external one being fusiform, measuring about 140 to 160 μ in length and 32 μ in breadth, it is prolonged at each pole into a filament which measures from 27 to 36 μ in length. The oncosphere measures 50 by 27 μ .

Family IX. DIPLOPOSTHIDÆ Poche, 1926

Head with an armed rostellum. Mature segments broader than long. Musculature well developed. A single or double set, or a partial duplication of male and female genital organs, in each segment. Vaginal pore present or absent. Cirrus very large and armed with spines. Uterus a transverse sinuous sac. Adults parasitic in birds.

Type-genus — *Diploposthe* Jacobi, 1896

Genus DIPLOPOSTHE Jacobi, 1896

Cestodes with short proglottides and an armed rostellum. Ovary and vitelline gland single, lobed, and situated in the middle of the segment. Vaginae double, opening one on each lateral margin of the segment. Uterus simple, forming a transverse cavity, testes usually three, rarely more numerous (seven), occupying, irregularly, the median zone of the segment. Each testis has several vasa efferentia which anastomose and form, on each side near the testes and ovary, a seminal vesicle, which is surrounded by prostatic cells, it is continued as the vas deferens, which opens, one on each lateral margin of the segment, into a strong cirrus pouch which lies dorsally to the vagina. Cirrus very large and strongly armed. Ripe eggs with three envelopes.

Type-species — *Diploposthe lævis* (Bloch, 1782)

Diploposthe lævis (Bloch, 1782) Jacobi 1896 (Fig 340)

Synonym — *Tænia lævis* Bloch, 1782

From (1) *Netta rufina*, (2) the tufted duck (*Nyroca fuligula*), (3) the eastern white-eyed duck (*Nyroca baeri*); Zoological Gardens, Calcutta Southwell (4) *Nyroca ferina*, and (5) ² *Strepsilas interpres*, Chilka Lake, Orissa, India. Southwell

The worm measures up to 50 cm in length and has a maximum breadth of from 3 to 9 mm. The segments are fleshy and broader than long, the genital pores are double in each segment. Strobilization begins immediately behind the head. The small scolex bears 10 hooks, each measuring from 16 to 21 μ in length. The testes are large and few, there being from three to seven in each segment (usually three),

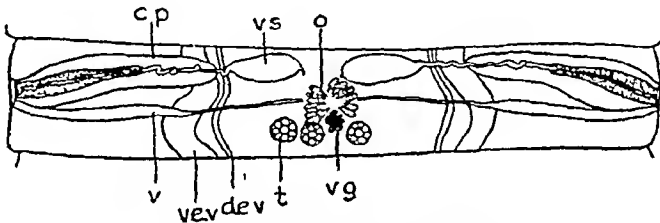


Fig 340 — *Diploposthe lævis* Mature segment, $\times 52$
(Original)

from each testis several vasa efferentia arise which anastomose, these form two coiled vasa deferentia, one on each side. A seminal vesicle is present, surrounded by prostatic cells. The cirrus sac, and especially the cirrus, is very strongly developed, the latter is often evaginated, it is armed with powerful hooks which measure from 8 to 14 μ in length, resembling in shape those on the head of a *Tænia* sp. The cirrus sac runs dorsally to the vagina. The single median ovary is bilobed, each wing being further divided into small tubules, the vitelline gland lies posteriorly to the ovary and resembles it in shape, but it is much smaller. The uterus is simple and transversely elongated, bearing large diverticula which extend dorsally and ventrally into the musculature.

Family X ACOLEIDÆ Ransom, 1909

Scolex generally armed, seldom without rostellum. Suckers unarmed. Strobila thick, with short segments. Musculature consists of at least two layers of longitudinal muscles alternating with layers of transverse muscles. A single set, double set, or partial duplication of reproductive organs in each segment. Male genital openings marginal. Female genital

(vaginal) opening lacking Cirrus always very large and armed with strong hooks or spines Eggs with thin transparent shells Adults in birds

Type-genus — *Acoleus* Fuhrmann, 1899

Genus GYROCÆLIA Fuhrmann, 1899

Synonym — *Brochocephalus* Linstow, 1906

Rostellum armed with a single row of hooks arranged in a zig-zag with eight angles A single set of reproductive organs in each proglottis Male genital pores irregularly alternate Cirrus sac passes between the longitudinal excretory vessels and dorsally to the nerve Testes usually few Receptaculum seminis small Vagina absent Uterus ring-like, with numerous out-pocketings and in gravid proglottides with two openings, one dorsal and the other ventral Adults in birds

Type-species — *Gyrocaelia perversa* Fuhrmann, 1899

Gyrocaelia paradoxa (Linstow, 1906) Fuhrmann, 1899 (Fig 341)

Synonym — *Brochocephalus paradoxus* Fuhrmann, 1908

From the lesser sand-plover (*Glareola lactea* = *Ægialitis mongolica*), Weligatta, Ceylon ? Willey

The worm attains a length of about 8.5 cm and a breadth of 3 mm All the segments are broader than long The male genital pores are irregularly alternate and are situated at the extreme anterior corner of the lateral margin of the segment The rostellum measures about 100 μ in length and 62 μ in breadth, it is armed with a single zig-zag row (thrown into about eight angles) of hooks, about 78 in all, each of which measures about 29 μ

The longitudinal muscles are strongly developed and consist of two layers of bundles alternating with layers of transverse muscle-fibres Apparently there are from 20 to 30 testes situated dorsally and displaced somewhat aporally by the enormous cirrus sac The latter organ is very muscular, and measures 400 μ in length and 18 μ in breadth, occupying one-third the transverse diameter of the segment, it passes between the longitudinal excretory vessels and dorsally to the nerve The cirrus is also enormous, broad, and strongly armed with spines, it is as long as half the transverse diameter of the segment

The ovary consists of two wings, each of which is somewhat lobulated, it occupies the major portion of the segment, the vitelline gland is posterior to it and is rather small The shell gland is a minute globular organ, situated between the vitelline gland and the ovary A vagina is absent.

At first the uterus assumes the form of a tubular ring, later on, numerous out-pocketings appear, the central area being filled with spongy tissue from which two short ducts open, one dorsal and one ventral, each by means of a pore

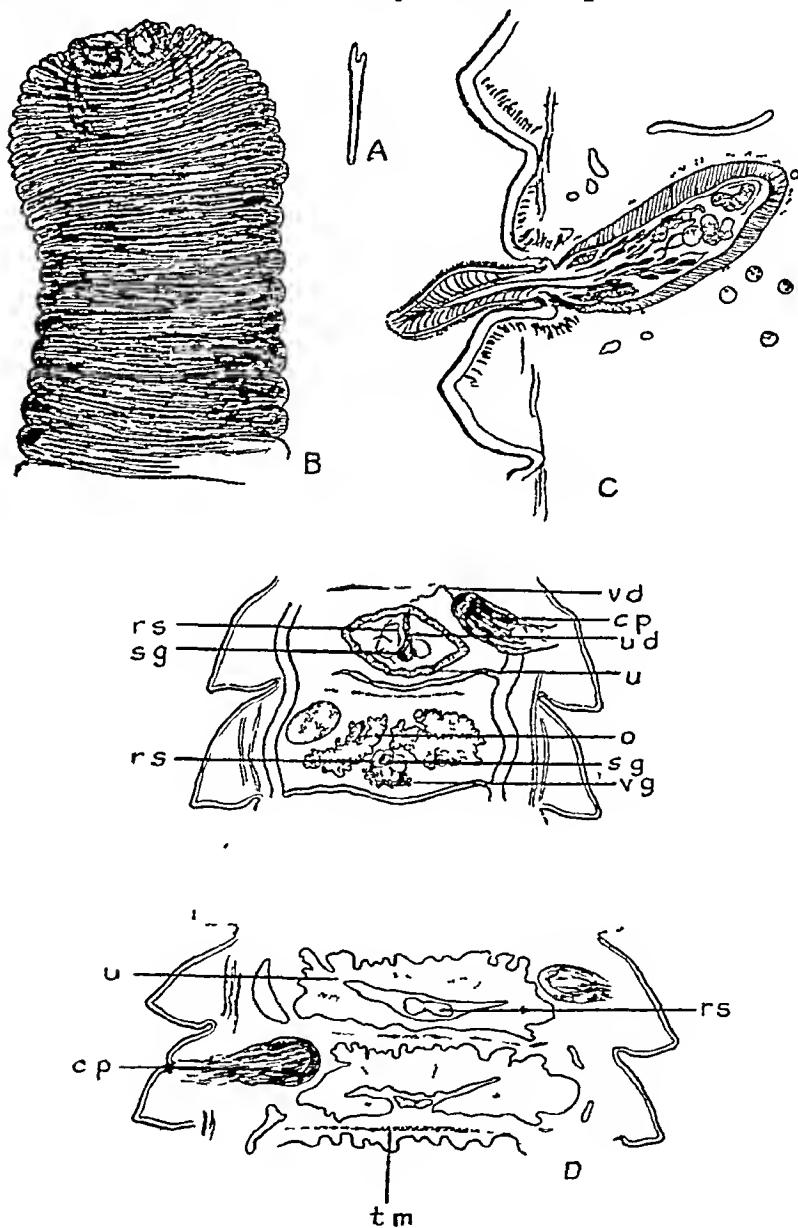


Fig 341 — *Gyrocœlia paradoxa* A, rostellar hook, magnification unknown (After Linstow), B, head, C, horizontal section, showing structure of cirrus pouch, D, horizontal sections of mature and gravid segments Magnification unknown (After Clausen')

Family XI TETRABOTHRIIDÆ Linton, 1891

The systematic position of this family is a matter of some doubt Fuhrmann (1907) placed it in the Cyclophyllidea Nybelin (1922) considered that it was closely related to the Abothriinæ, and consequently placed it in the Pseudophyllidea Poche (1925) agreed with Nybelin, and made the family into a tribe of the Bothrioccephaloidea Diesing, 1850 Baylis (1926) points out that the genus *Dinobothrium* Ben, 1889, has affinities with the family Tetrabothriidæ, and proposed that the genus should be included in it

The present writer includes the family in the superfamily Tainioidea Characters —Scolex unarmed, without rostellum Suckers usually with an outwardly projecting auricular appendage on the anterior border A single set of reproductive organs in each proglottis Genital pores unilateral Cirrus sac small and nearly spherical, usually united with the genital atrium by a muscular canal Vitelline gland anterior to the ovary Rudimentary uterine pore present or absent Eggs with thin transparent envelopes Adults in birds and mammals

Type-genus —*Tetrabothrius* Rudolphi, 1819

Genus TETRABOTHRIUS Rudolphi, 1819

Synonyms —*Amphopterocotyle* Diesing, 1853

Eutetrabothrium Diesing, 1854

Prosthecocotyle Monticelli, 1892

Bothriodontenia Lonnberg, 1896

Acetabular appendages and muscular atrial canal present, genital pore on left side of strobila Cirrus and genital atrium without, or with a few, hairs Adults in birds and mammals

Type-species —*Tetrabothrius emmerinus* (Abildgaard, 1790)

Tetrabothrius erostis (Lonnberg, 1889) Fuhrmann, 1899

Synonyms —*Tania erostis* Lonnberg, 1889

Rhynchotania erostis Lonnberg, 1889

Prosthecocotyle erostis (Lonnberg, 1889) Fuhrmann, 1899

From *Sterna bergi*, Negombo Lake and Tamblegam, Ceylon
? Willey

The worm measures up to 8 cm in length and has a maximum breadth of about 3 mm The scolex measures about 450 μ in length, each sucker bears a little lappet The inner longitudinal muscles consist of from three to eight bundles

There are from 30 to 32 testes The cirrus sac measures about 60 μ in length, the genital pores are unilateral and are situated at the apex of a papilla

Family XII DIECOCESTIDÆ, nov

Cestodes in which the sexes are separate, *i e*, some strobila contain only male and others only female organs

Type-genus — *Diæcocestus* Fuhrmann, 1900

Genus DIECOCESTUS Fuhrmann, 1900

Strobila dioecious Scolex usually with armed rostellum Male with a double set, female with a single set of reproductive organs, in each proglottis Vagina irregularly alternate, reaching almost to the margin of the proglottis Uterus a transverse sac with dorsal outgrowths Adults in birds

Type-species — *Diæcocestus paronai* Fuhrmann, 1900

Diæcocestus novæ-guineæ Fuhrmann, 1914 (Fig 342)

From the little grebe (*Podiceps albipennis*), Zoological Gardens, Calcutta Southwell

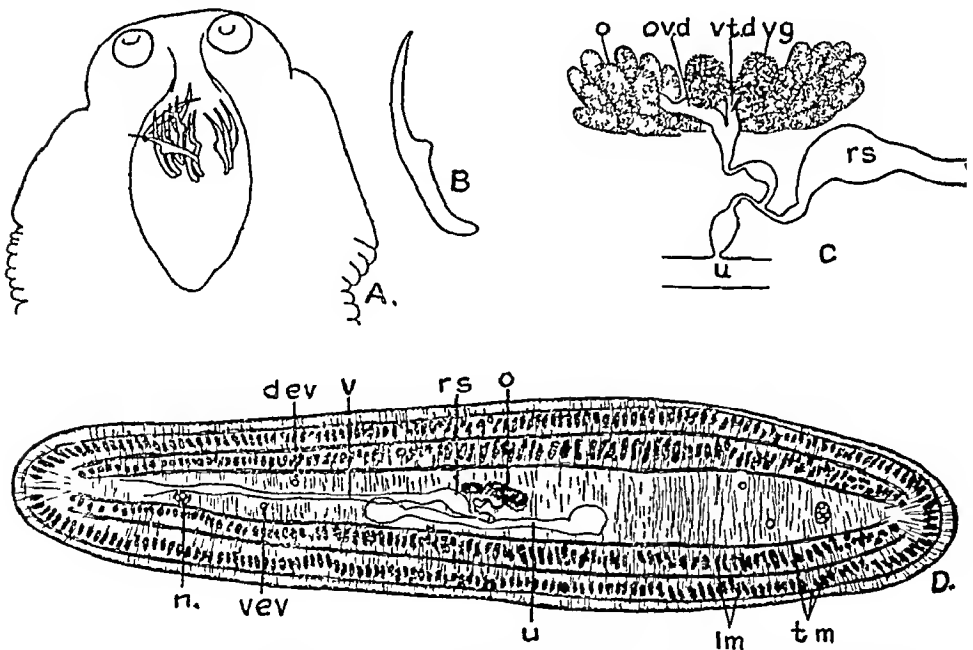


Fig 342 — *Diæcocestus novæ-guineæ* A, head of ♀, $\times 24$, B, rostellar hook, $\times 42$, C, female genitalia, $\times 80$, D, transverse section of ♀, showing musculature and genitalia, \times about 20 (Original)

Two male worms and one female have been recorded from the above host The former had a length of 10 cm, a maximum breadth of 5 mm, and a thickness of 1 mm, the hooks were missing, and the only trace of genitalia consisted of two cirrus sacs in each segment, each of which measured 750μ in length

and $330\ \mu$ in breadth, the cirrus was apparently unarmed. The female worm measured 17 cm in length, 6 mm in breadth, and had a thickness of 1.6 mm.

All the segments are broader than long, the lateral posterior margins being salient. The head of the male worm had a length of $100\ \mu$ and a breadth of $60\ \mu$, whilst the head of the female worm had a length of $800\ \mu$ and a breadth of $900\ \mu$. As will be noted, the male heads are very small and are retractile within the anterior end of the strobila, which latter lies behind the head like two shoulders. Twelve hooks were counted on the female head, each hook having a length of $320\ \mu$ —it is possible that a few were missing, they resemble those figured by Luhe for *D. aspera* (Mehlis), but in the latter species the hooks measure only from 200 to $218\ \mu$ in length and are 14 in number.

The muscular system is well developed, the longitudinal muscles consist of two layers of bundles, the outer layer being almost as large as the inner layer. The circular fibres are in three layers, one layer external and another layer internal to the longitudinal muscles. The dorsal excretory vessel is feebly developed, having a diameter of $25\ \mu$ only. The ventral vessel has a diameter of $90\ \mu$. Externally to the longitudinal excretory vessels there is a well developed nerve which has a diameter of $100\ \mu$.

The ovary was not seen in its fully developed condition, but it is situated in the middle of the medullary parenchyma, the vitelline gland is a globular granular organ just posterior to the ovary. From the pore the vagina pursues an almost straight course to the middle of the ovary, where it dilates into a conspicuous receptaculum seminis.

The uterus arises ventrally to the ovary as a transverse tube which later on fills the entire segment and appears to be divided up into loculi by ingrowths of septa from the uterine wall. The egg has a diameter of about $42\ \mu$ and the oncosphere $25\ \mu$. The hooks in the embryo have a length of $13\ \mu$.

GENERA OF UNCERTAIN SYSTEMATIC POSITION

Genus I ECHINOBOTHRUM van Beneden, 1850

Van Beneden established this genus in 1850, but did not at that time define its characters. Braun did so, however, in 1900—"The number of hooks on the head varies according to the species, and so does the number of hooks in the longitudinal rows on the neck. In many forms there is, on the anterior part of the head, a 'proboscis-like' collar which bears hooks having bowl-shaped bases. Genital pores in the middle of the ventral surface or near the posterior margin. Eggs with or without appendage.

"Type—*Echinobothrium typus* van Ben, 1850."

(1) *Echinobothrium typus* van Ben , 1850 (Fig 343)

Synonym — *E. boisi* Southwell, 1911

From *Stoasodon narinari* , Pearl Banks, Ceylon Southwell
Van Beneden's description of the above type-species was
as follows —

"First generation a scolex (scolexoide) Second generation
strobiloide —Body elongate, flattened, ending in a distinct

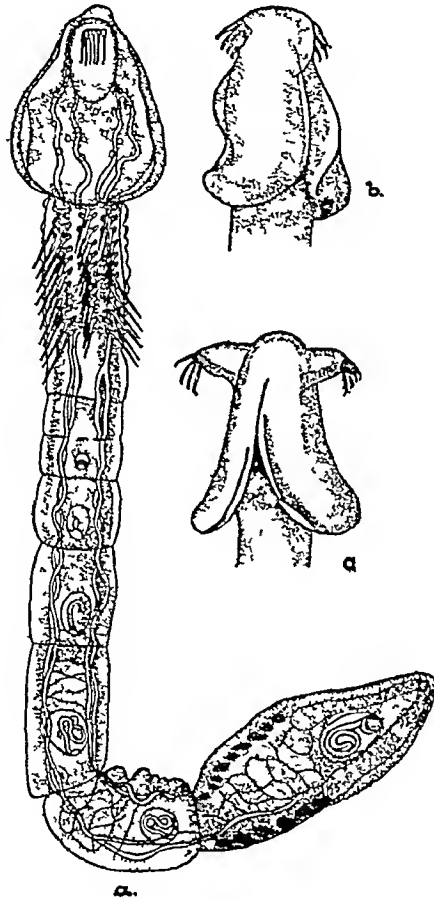


Fig 343 — *Echinobothrium typus* a, entire worm, b and c, views of the head Magnification unknown (After van Beneden)

hammer-shaped head bearing two rows of hooks , three rows of spines on each side of the neck The cirrus opens on the median line Length of worm up to 5 or 6 mm Third generation (free proglottides) —Body elongated, circular, with no

other external opening except the opening of the flask-shaped cirrus. The cirrus is rugose at its base end and, when ejected, is almost as long as the body, the proglottid is 1 mm in length. Eggs very small and not measuring more than 0.01 mm. The hooks on the head are in one row, and their point is slightly curved inwards, at its anterior third each hook bears a slight eminence or tubercle which is easily detached. There are nine hooks on each side.

“*Spines* These are straight and slender, ending in three apophyses (tubercles) at the proximal end, by means of which they are fixed to the worm. They are arranged in three longitudinal rows of twelve to thirteen spines each.

“*Ovary*. This is situated at the side and occupies practically the whole length of the worm, it looks like a string of beads and is best seen when ‘germs’ are formed but not evacuated.” (It is figured as a U-shaped organ.)

“*Vitelline glands* Numerous cells, more or less irregular, fill the middle of the body.” (They are shown laterally, in front of the ovary, in van Beneden’s figure.)

“*Testes* In the body one sees an organ, dull in colour, which presents the form of a coiled-up cord like the testicle of an insect. It has a definite wall and could be uncoiled.”

For a long time van Beneden believed that this cord terminated at the base of the cirrus, but was never able to satisfy himself on this point. He regarded this organ as the testicle or “spermogene,” but did not believe that it passed its products to the exterior.

“There is complete hermaphroditism.

“*Affinities* The worm must be placed in the neighbourhood of the armed Bothriocephalids, but cannot be included in any of the established genera.”

In 1858 van Beneden defined the characters of the genus *Echinobothrium* as follows — “A double rostellum with hooks; two big, very mobile bothridia, and a spiny neck.”

He also added the following description of *E. typus* —

“Length of strobila, 5 to 6 mm, length of proglottis, 1 mm.

“*Scolex* Head very mobile, flattened. The two bothridia seem joined together during life. The edges of the bothridia are denticulated, the bulb is armed with hooks inside the head, and extends anteriorly. There is a double rostellum armed with a double row of hooks. Beneath the bulb lies a bundle of muscular fibres. The hooks are arranged in a single row and point posteriorly. There are from nine to sixteen on each side. They occupy two planes, and are of the same length and shape, being broader at the base, the point bending slightly downwards. The longitudinal canals in the head are four in number. Neck well defined and flattened throughout. On

each side there are three rows of spines, these are straight, pointed, and terminate, at their base, in three apophyses (tubercles) There are twelve or thirteen hooks in each row, pointing posteriorly Neck as long as the head, but not as wide Patches of red pigment occur beneath the spines

"*Strobila* There are from eight to ten segments, the last ones are two or three times longer than broad, the first ones being much broader than long The penis opens on the same side in the median line

"*Proglottides* The penis is situated in the posterior third of the segment and is covered with spines The testes are placed anteriorly in the middle of the segment and are made up of several transparent vesicles which fill the segment The spermatic reservoir consists of a twisted canal, placed in the median line, at the base of the penis, the ovary consists of two long cæca situated posteriorly and joined at their base Eggs 0.01 mm, pointed at one end, flattened and broad at the other. Shell simple and very thin, without filaments They accumulate in a uterus which fills the whole segment "

Wagener, in 1854, referred to the species *E typus*, a worm which Leuckart and Pagenstecher (1858) considered distinct, and which Diesing, in 1863, named *E affine*

ECHINOBOOTHRIUM BOISI Southwell, 1911

The author described this worm as follows — "The worm measured 1 cm long, but all the ripe proglottides were missing The head is 2 mm long, and consists of an anterior umbrella-like structure 1.3 mm broad, bearing numbers of long, pointed, curved, yellow spines, or coronal hooks, clustered at each side This is succeeded by a somewhat bulbous neck, devoid of spines and overhung, and somewhat hidden, by two lappets, which are united over the bulbous portion along the greater part of their length It was not determined whether this neck was segmented or not Succeeding the neck, and commencing immediately at the posterior end of the lappets, is an armed portion, or '*Kopfstrich*,' 1.3 mm long This bears eight longitudinal rows of minute teeth with 24 teeth in each row These teeth are apparently triradiate, the paired shorter processes of each tooth being anterior, and their lateral terminations being either pointed or knobbed. The point of juncture of these parts of the teeth is somewhat thickened The strobila commences immediately The segments are first much broader than long, becoming square, then cylindrical The sides and division lines of the segments are perfectly straight Our worm had no ripe proglottides, so that no observations were made on the reproductive anatomy One specimen Portugal Bay December 18, 1910 "

(2) *Echinobothrium affine* Diesing, 1863 (Fig 344)

From *Carcharias* sp and *Rhina halavi* , Negapatam, India
Pearson

Worms of this species usually possess three, rarely four, segments. In every case the last segment was longer than the rest of the worm.

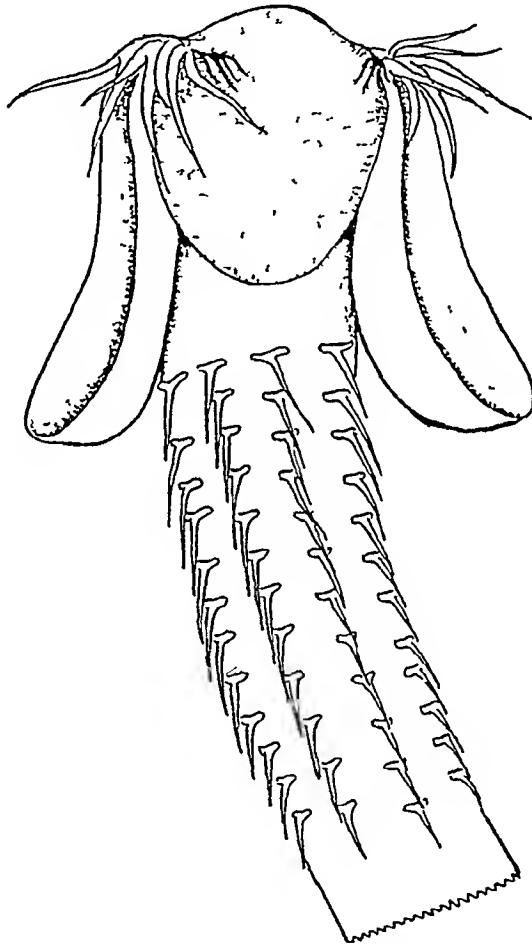


Fig 344 — *Echinobothrium affine* Head, $\times 340$
(After Southwell)

The 'Kopfstiel' bears eight longitudinal rows of hooks, each hook with three roots, the number of hooks in each row varies from twelve to fourteen, the usual number being twelve. The hooks decrease in size and length posteriorly, the anterior hooks being stout and measuring 65μ in length, whilst the

posterior hooks are very slender and measure only $35\ \mu$ in length

On each side of the head there is a group of about eleven large hooks, the central hooks being slightly the largest and measuring $75\ \mu$. On each side of each group of large hooks there are three or four minute hooks varying in size from 8 to $13\ \mu$.

(3) *Echinobothrium rhinoptera* Shipley & Hornell, 1906

From *Rhinoptera javanica*, Pearl Banks, Ceylon Hornell

"Along with the *Eumochobothrium gracile* a few specimens of a curious Cestode which we place with the genus *Echinobothrium* were found. The specimens measured about 3 mm in length, the head slightly over 0.2 mm. As a rule in the genus *Echinobothrium* the head is succeeded by a portion called the 'Kopfstiel' by German writers. This bears eight rows of very characteristically shaped spines. In our specimen, however, the head is borne by a long 'neck', devoid of spines. This 'neck' is 0.3 mm in length and in the fresh condition it seemed strobilized but in the stained and mounted preparations this seems not to be so much a real strobilization as a more or less wrinkling of the cuticle. Unfortunately, the number of specimens was so small that we could not settle this point by an appeal to the knife.

"The 'neck' is followed by an armed region 0.2 mm long. This has eight longitudinal rows of characteristic *Echinobothrium* teeth, with their basal process, their long, fine point, and the two side rods at right angles to the rest. The number of teeth in each row was either twelve or thirteen. The armed region was greater in circumference than the neck. Behind, the body soon broke up into proglottides, and of these, seven or eight could be recognised as distinct. They increase very rapidly in size, and in our mounted specimen the seventh proglottis is 0.75 mm in length and 0.2 mm in breadth, and occupies a bulk of about one-half to one-third the rest of the body. The only internal organs visible are the testes, arranged much as those of *E. musteli* as figured by Pintner, the cirrus bulb and the cirrus. When the latter was exerted it was seen to bear very numerous minute recurved hooks. The two points in which this Cestode differs from the other members of the genus, e.g., *E. affine*, *E. typus*, *E. brachysoma*, and *E. musteli* are the complete absence of any spines on the head and the presence of the naked region or 'neck' between the head and the armed region of the body. On the other hand the shape of the head with its four [*sic*] projecting lappets and its intervening spoon-like depressions, the armed region, the shape of the teeth, the number of the rows of teeth, the

number of the proglottides, the arrangement of the testes, all resemble what we know of the genus, and justify us in including this amongst the species of *Echinobothrium* "

The species differs from all other species in the genus in having an elongated unarmed portion of the worm situated between the head and the "Kopfstiel" The absence of hooks from the head is probably due to their having been lost

- (4) *Echinobothrium longicolle* Southwell, 1925 (Figs 345, 346, & 347)

From *Dasybatus kuhli*, Pearl Banks, Ceylon Southwell

The preserved worms measure from 2 to 3 cm in length and are composed of about fifty segments The genital pores are situated on the ventral surface in the posterior third of the segment

Head The head measures about 1.1 mm in length and 900 μ in breadth, it is made up of two rounded or slightly elongated bothridia surrounding a central portion, no hairs were seen on the bothridia Anteriorly the head terminates in a muscular disc formed by the fusion of the two bothridia and the central portion This muscular extremity bears two separate crowns of hooks, one on each side, by means of powerful longitudinal and circular muscles the central area of the terminal part of the head can be retracted, and when retracted a deep fossa is produced, at the mouth of which the two crowns of hooks come to be situated Each crown contains about twenty hooks, and each hook has a length of about 90 μ Spines similar to those on the collar of *E. musteli* were definitely absent Immediately posterior to the two bothridia the "Kopfstiel" begins, and this structure is characteristic of the species, it measures about 5 mm in length and is armed with an enormous number of hooks, there are about 180 hooks in each antero-posterior row, and eight hooks in each transverse row These hooks are curved and have a length of about 35 μ , they arise from an irregularly shaped base, the point on one hook overlaps the base of the next posterior hook Posteriorly to the "Kopfstiel" there is a short neck, measuring about 0.4 mm in length

No details regarding the muscular, excretory, and nervous systems are available, but a pair of excretory vessels were clearly seen in whole mounts, running along each lateral margin of the worm

Male Genitalia When immature the testes are situated in the median field, but when fully developed they occupy the entire anterior two-thirds of the segment, each testis has a diameter of about 120 by 90 μ when fully mature, the number of testes varies from twenty-six to thirty The cirrus pouch is pyriform and opens on the ventral surface the vas deferens is a long tube bent upon itself but not coiled

Female Genitalia The ovary is situated quite posteriorly and is bilobed, each lobe consists of a few club-shaped acini radiating outwards fanwise. The vagina apparently follows

Fig 345

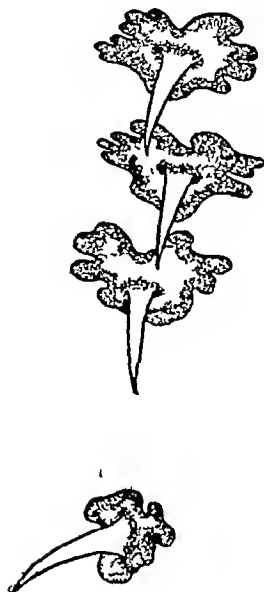


Fig 346

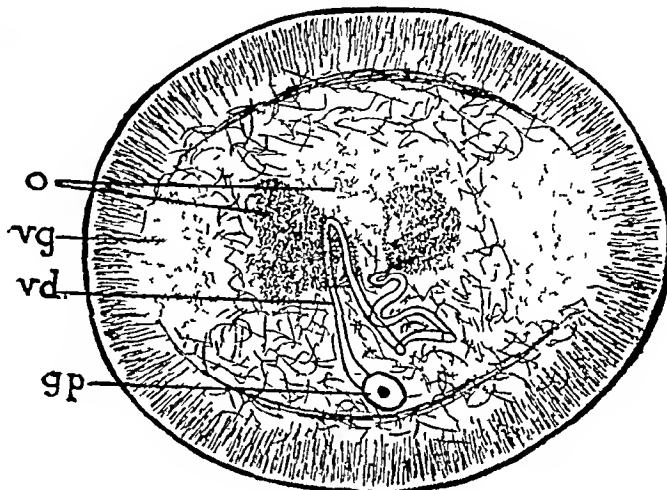
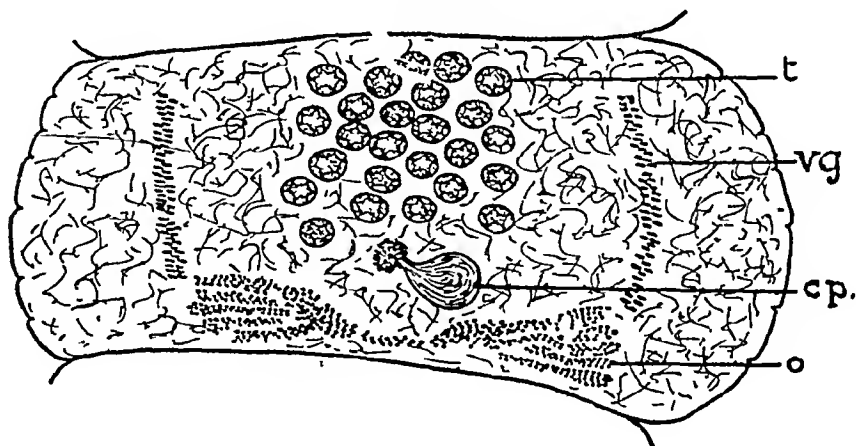


Fig 347



Echinobothrium longicolle.

Fig 345 — Neck-hooks, $\times 500$ (After Southwell)

Fig 346 — Transverse section of mature segment, $\times 69$ (After Southwell)

Fig 347 — Mature segment, $\times 112$ (After Southwell)

a straight course from the ovary to the genital pore where it opens posteriorly to the cirrus pouch, shell gland small or absent. The vitelline glands are rather inconspicuous, they

are paired and are situated laterally. The uterus consists of a tube running along the median antero-posterior axis, the oviduct opens at its posterior extremity. In the last segments the uterus usually contains eggs, the majority of these are globular, but sometimes they are elongated, and bluntly pointed at one extremity. The eggs are separate and not in clusters.

This species is different from all other species in the genus in having the "Kopfstiel" armed with hooks, of which there are about 180 in each antero-posterior row, and eight in each transverse row.

Genus II *PILLERSIA* Southwell, 1927

The head is unarmed and is composed of two undivided bothridia. One surface of each bothridium is puckered and thrown into folds, resembling in this respect certain species of the genus *Phyllobothrium*. Accessory suckers are absent. Parasites in sharks and rays.

Type-species — *Pillersia oweni* Southwell, 1927

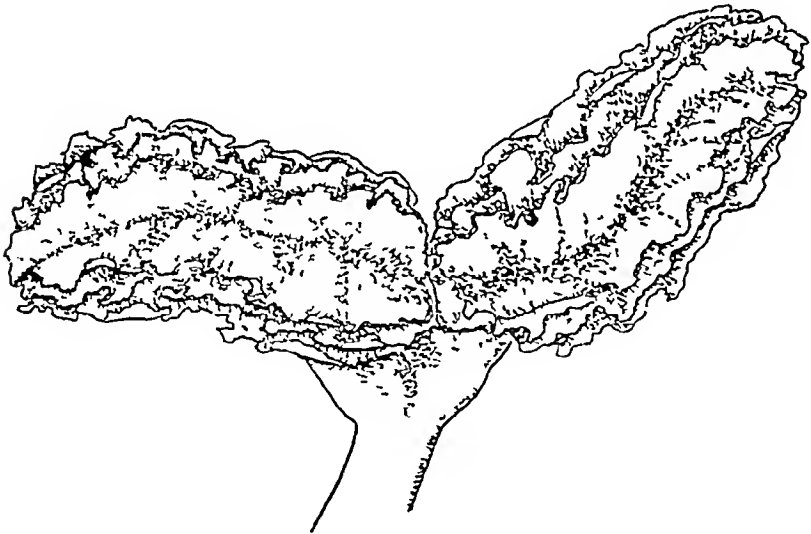


Fig 348 — *Pillersia oweni*. Head, \times about 60
(After Southwell)

Pillersia oweni Southwell, 1927 (Fig 348)

From *Urogymnus asperrimus*, Pearl Banks, Ceylon
Southwell

The longest specimen measures 1.8 cm in length, 150 μ in breadth, and consists of a neck bearing at its anterior extremity two bothridia, each of which measures 800 μ in length,

The bothridia extend laterally at an angle to the neck, their posterior surfaces are smooth, but their margins and anterior surfaces are puckered and folded very much as are those of *Phyllobothrium foliatum*. Accessory suckers are absent.

The neck is very long, measuring up to 1.8 cm. No segments were obtained and consequently a description of the genital organs is not possible. The species is easy to identify on account of the head bearing only two bothridia.

Genus III DISCOCEPHALUM Linton, 1890

"Body articulate, taeniaeform. Head composed of two parts. The anterior part a muscular disk which is entire, or notched at the edge. The posterior part (neck) short, globose, with an inflated or corrugated surface. Neck (unsegmented part of body) much narrower than head, continuous with body. No supplemental disks. Genital apertures marginal.

"Type species — *Discocephalum pileatum*, from *Carcharias obscurus*" (Linton).

Linton stated that this genus, together with the genera *Tylocephalum* and *Lecanicephalum*, should be placed in a new family, for which he suggested the name *Gamobothridæ*.

(1) *Discocephalum pileatum* Linton, 1890 (Fig. 349)

From *Carcharias gangeticus*, Pusser River, Khulna, Bengal, India. Southwell.

"Head, a transversely flattened apical disk, entire, or with a single lateral notch, followed by a much smaller, globular, inflated, cervical mass, with botryoidal or corrugated surface, yellowish in colour, and separated from the apical disk by a narrow, orange-coloured band. Neck (unsegmented part of body) narrower than head, merging into segmented body. Anterior segments very short, much crowded, subsequent segments longer than broad, mature segments irregularly squarish, very changeable in living specimen. Strobile flat, increasing in breadth uniformly to the beginning of mature segments, beyond which point it is somewhat narrower.

"Genital apertures marginal a little in front of middle, male and female approximate. Cirrus long and slender, vagina opening in front of cirrus. Length (maximum), 530 mm; diameter of anterior disk 3 to 5 mm; greatest breadth of body 3 to 5 mm. *Habitat* — *Carcharias obscurus*, spiral valve. Wood's Hole, Massachusetts, July 19, 1886. One adult, three young" (Linton).

Linton differentiated two varieties, one having the apical disc entire and the other having a profound lateral notch in the apical disc. The measurements in millimetres of the single adult specimen were as follows — Length, 530,

marginal diameter of disc, 3.5, lateral diameter of disc, 3, thickness of disc, 1.25, diameter of cervical mass, 2, breadth of unsegmented part of body, 1.12, greatest breadth of body, 115 mm from head, 5, length of segments, 115 mm from head, 1, length of posterior segments, 2.45, breadth of posterior segments, 3.25, longer diameter of ova, 0.11, shorter diameter of ova, 0.08

Male Genitalia The testes are arranged in racemose clusters on branches which are transverse to the axis of the segment, the clusters are granular and measure from 700 to 860 μ in diameter. The cirrus pouch is oblong when the cirrus is retracted, and it measures about 280 μ in diameter and 600 μ

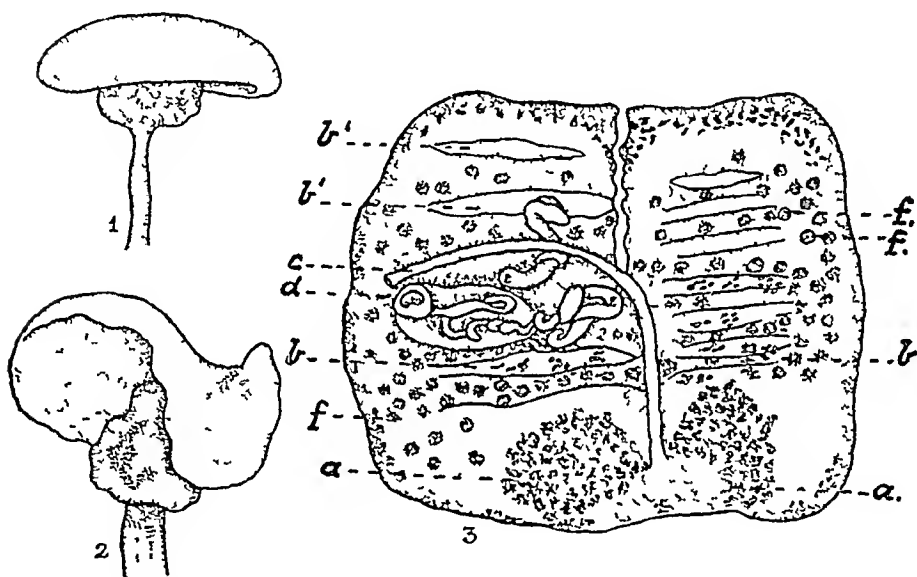


Fig 349—*Discocephalum pileatum*. 1 and 2, head, showing variations in appearance, $\times 9$, 3, horizontal section of mature segment—*a*, ovary, *b*, uterine cavities with clusters of eggs, *b'*, uterine cavities devoid of eggs, *c*, vagina, *d*, base of invaginated cirrus, *f*, testes \times about 8 (After Linton)

in length. The cirrus is very long, slender, and unarmed. Outside the pouch the vas deferens is voluminous and coiled, some of the coils having a diameter of 140 μ .

Female Genitalia The ovary lies posteriorly and is bilobed. From the pore the vagina runs in front of the cirrus pouch, it then turns abruptly and runs backwards to the ovary. The shell gland lies between the two lobes of the ovary, it has a diameter of about 90 μ , and is, in fact, a closely coiled tube. The vitelline glands are condensed into a single mass and are apparently situated posteriorly. Linton states that posteriorly the shell gland "connects with an irregular mass

which I take to be the vitelline gland This, when magnified appeared as an irregular, slightly striated, glandular organ which was sharply differentiated from the surrounding parts and measured 0.2 mm in length and 0.24 mm in breadth " Linton was unable to differentiate the outlines of the uterus, but he noted that in mature segments there was a longitudinal dehiscent opening along the median line

The eggs are oval, brown in colour, and measure 80 by 110 μ

The worm is peculiar in having a single vitelline gland, which is situated posteriorly to the ovary In this respect it resembles *Tylocephalum uarnak*

Genus IV *DIAGONOBOTHRUM* Shipley & Hornell, 1906

Head 2.3 mm in length, about 1 mm in breadth There is a large terminal muscular sucker, and two ear-like bothridia,

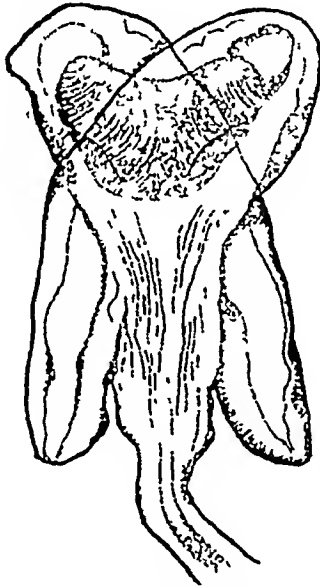


Fig. 350 — *Diagonobothrium asymmetrum* Head, $\times 30$.
(After Shipley and Hornell)

which run down right and left of the head One edge of each of these bothridia runs forward obliquely, and loses itself in the crinkled membrane which surrounds the terminal sucker There is only one edge on each side thus prolonged, and the two prolongations cross one another at about a right angle The head is thus asymmetrical The neck is long and shows hardly any structure.

Type-species — *Diagonobothrium asymmetrum* Shipley & Hornell, 1906

Diagonobothrium asymmetrum Shipley & Hornell, 1906
(Fig 350)

From *Aetomylæus maculatus*, Pearl Banks, Ceylon Hornell

This species was described from a single specimen, of which only the head and neck were obtained. The head consists of a large terminal sucker and of two lateral, hollow, asymmetrical bothridia. The neck is long. The authors state that "one could not put from one's mind that it (i.e., the head) might be an abnormality, especially as only one species was taken and that without any proglottis."

WORMS OF UNCERTAIN IDENTITY

(1) *Cestoda* sp Southwell, 1922

From *Loris gracilis*, Zoological Gardens, Calcutta Southwell

About ten segments of a worm were obtained from the above host, each segment is much broader than long, the maximum breadth being about 2 mm. The genital pores are irregularly alternate. The ovary is central, anterior and fan-shaped, the testes being posterior and extending across the segment. The cirrus is unarmed. The eggs are round and measure $35\ \mu$, they are not in capsules. They have a double covering and contain a hexacanth embryo, but no pyriform apparatus. Owing to lack of material and absence of a head, it is impossible to say to which genus the specimens belong.

(2) *Cestoda* sp Southwell, 1922

From *Sterna fluviatilis*, Zoological Gardens, Calcutta Southwell

Fragments of a tapeworm which it was impossible to relegate to any particular genus have been recorded from the above host.

(3) *Cestoda* sp Meggitt, 1926

From *Corvus splendens insolens*, Rangoon Meggitt

Meggitt records an unidentified larval form from the above host.

(4) Moghe (1926) recorded undetermined species of cestodes from (1) the hawk cuckoo, (2) the argus pheasant, (3) the peacock pheasant (two species), and (4) also tapeworm cysts from the mesentery of a rat snake.

(5) *Cysticercus* have been recorded by Shipley (1903) from *Cervus axis* in Ceylon, but the species is unknown.

CLASSIFIED LIST OF CESTODES FROM INDIA WITH THEIR HOSTS

Order I CESTODARIA Monticelli, 1892

Family I CARYOPHYLLIDÆ Leuckart (quoted by Claus, 1885)

Genus CARYOPHYLLUS Mueller, 1787

Parasite	Host
<i>Caryophyllæus indicus</i> Moghe 1925	<i>Clarias batrachus</i>

Family II AMPHILINIDÆ Claus, 1889

Genus AMPHILINA Wagener, 1858

- | | |
|---|--|
| 1 <i>Amphilina magna</i> Southwell, 1915 | <i>Diagramma crassispinum</i> |
| 2 <i>Amphilina paragonopora</i> Wood-land, 1921 | <i>Macrones aor</i> , <i>M seenghala</i> , <i>Bagarius yarrelli</i> (= <i>Pinelodus bagarius</i>) |

Order II EUCESTODA, nov

Superfamily I DIBOTHRIOCEPHALOIDEA Stiles, 1906

Family I DIBOTHRIOCEPHALIDÆ Luhe, 1899

Subfamily 1 DIBOTHRIOCEPHALINÆ Luhe, 1899

Genus I DIBOTHRIOCEPHALUS Luhe, 1899

- | | |
|--|---------------------------------------|
| 1 <i>Dibothriocephalus felis</i> (Creplin, 1825) | <i>Felis tigris</i> , <i>F pardus</i> |
| 2 <i>Dibothriocephalus reptans</i> (Diesing, 1850) | <i>Tropidonotus</i> sp |
| 3 <i>Dibothriocephalus ranarum</i> (Gas taldi, 1854) | <i>Rana tigrina</i> (larval forms) |
| 4 <i>Dibothriocephalus</i> sp Moghe, 1926 | <i>Felis bengalensis</i> |
| 5 <i>Dibothriocephalus</i> sp Southwell, 1922 | Black leopard (? <i>Felis melas</i>) |
| 6 <i>Dibothriocephalus</i> sp Southwell, 1922 | <i>Paradoxurus grayi</i> |

Genus II BOTHRIDIUM Blainville, 1824

- | | |
|---|--|
| 1 <i>Bothridium pithonis</i> Blainville, 1824 | <i>Python reticularis</i> , <i>P molurus</i> , <i>Felis tigris</i> (probably an accidental host) |
| 2 <i>Bothridium</i> sp Moghe, 1926 | Rock snake (<i>Python</i> sp) |

Larval forms

Host

& *Balistes stellatus*, *B. mitis*, *Pinna* sp

nton, *Caranx* sp, *Thynnus* sp

929 *Cybium guttatum*, *Cossyphus axillaris*,
Trichiurus savala, *Chorinemus ly-*
san, *C. toloo*, *Lutjanus argenti-*
maculatus, *L. gibbus*, *Balistes*
stellatus, *B. mitis*, *B. sp*, *Serranus*
undulosus, *Psettodes erumei*

929 *Cossyphus axillaris*, *Lutjanus argenti-*
maculatus, *Drepane punctata*, *Dia-*
gramma sp, *Serranus undulosus*

es inquirendæ

ing, *Dasybatus walga*

y & *Rhynoptera javanica*, *Dasybatus* sp,
Ginglymostoma concolor Larvæ
in the pearl oyster (*Margaritifera*
vulgaris)

RUDOLPHI, 1819

) *Dasybatus walga* Larvæ in *Hemi-*
galeus balfouri, *Pristis cuspidatus*,
Cybium guttatum, *Chorinemus toloo*,
Arius gagora, *Chirocentrus dorab*,
Trichiurus savala, *Serranus* sp,
Balistes sp, *Lutjanus* sp, *Clupea*
ilisha, *Harpodon nehereus*
Microplatea micrura, *Dasybatus kuhl*

ANTON, 1890

'us, *Rhynchobatus djid-*

7, *Balistes*
Lutjanus
14

(b) Larval forms

Parasite	Host
<i>Tetrarhynchus balistidis</i> Shipley & Hornell, 1904	<i>Balistes mutus</i> , <i>B. stellatus</i>
<i>Tetrarhynchus pearsoni</i> Southwell, 1929	<i>Cybrum guttatum</i>
<i>Tetrarhynchus</i> sp Shipley & Hornell, 1906	<i>Balistes mutus</i>

Species inquirenda

<i>Tetrarhynchus minimus</i> Linstow, 1904	<i>Tænura melanospila</i>
--	---------------------------

Genus II TENTACULARIA Bosc, 1797

(a) Adult worms

<i>Tentacularia minuta</i> (van Ben, 1858)	<i>Carcharias</i> sp, <i>Rhina halavi</i>	
<i>Tentacularia longispina</i> (Linton, 1890)	<i>Dasybatus walga</i>	
<i>Tentacularia macrocephala</i> (Shipley & Hornell, 1906)	<i>Dasybatus walga</i> , <i>D. kuhl</i> , <i>Rhynchobatus djiddensis</i>	
<i>Tentacularia macropora</i> (Shipley & Hornell, 1906)	<i>Dasybatus uarnak</i> , <i>Stegostoma tigrinum</i> , <i>Galeocерdo archicus</i> , <i>Dasybatus</i> sp	
<i>Tentacularia atobatidis</i> (Shipley & Hornell, 1906)	<i>Stoasodon narinari</i>	
<i>Tentacularia rhynchobatidis</i> (Shipley & Hornell, 1906)	<i>Rhynchobatus djiddensis</i>	Larvæ in <i>Balistes stellatus</i>
<i>Tentacularia gangeticus</i> (Shipley & Hornell, 1906)	<i>Carcharias gangeticus</i>	
<i>Tentacularia carcharidis</i> (Shipley & Hornell, 1906)	<i>Carcharias melanopterus</i>	
<i>Tentacularia leucomelana</i> (Shipley & Hornell, 1906)	<i>Dasybatus sephen</i> , <i>D. kuhl</i> , <i>Rhynchobatus djiddensis</i>	
<i>Tentacularia binunca</i> (Linton, 1909)	<i>Dasybatus</i> sp, ? <i>walga</i>	
<i>Tentacularia spinulifera</i> (Southwell, 1911)	<i>Rhynchobatus djiddensis</i>	
<i>Tentacularia rossi</i> (Southwell, 1912)	<i>Dasybatus kuhl</i> , <i>D. walga</i> , <i>Rhynchobatus djiddensis</i> , <i>Stoasodon narinari</i>	
<i>Tentacularia ilisha</i> (Southwell & Prasad, 1918)	<i>Carcharias gangeticus</i>	Larvæ in <i>Clupea ilisha</i>
<i>Tentacularia johnstonei</i> Southwell, 1929	<i>Dasybatus sephen</i>	
<i>Tentacularia michæ</i> Southwell, 1929	<i>Rhynchobatus djiddensis</i> , <i>D. sephen</i> , <i>D. kuhl</i>	
<i>Tentacularia obesa</i> Southwell, 1929	<i>Dasybatus sephen</i>	

(b) Larval forms

Parasite	Host
<i>Tentacularia pinnæ</i> (Shipley & Hornell, 1904)	<i>Balistes stellatus</i> , <i>B. mitis</i> , <i>Pinna</i> sp
<i>Tentacularia spiracornuta</i> (Linton, 1907)	<i>Caranx</i> sp, <i>Thynnus</i> sp
<i>Tentacularia macfie</i> : Southwell, 1929	<i>Cybrum guttatum</i> , <i>Cossyphus axillaris</i> , <i>Trichurus savala</i> , <i>Chorinemus lysan</i> , <i>C. tolo</i> , <i>Lutjanus argente-maculatus</i> , <i>L. gibbus</i> , <i>Balistes stellatus</i> , <i>B. mitis</i> , <i>B. sp</i> , <i>Serranus undulosus</i> , <i>Psettodes erumei</i>
<i>Tentacularia pilleri</i> : Southwell, 1929	<i>Cossyphus axillaris</i> , <i>Lutjanus argente-maculatus</i> , <i>Drepane punctata</i> , <i>Diagramma</i> sp, <i>Serranus undulosus</i>

Species inquirendæ

<i>Tentacularia rubromaculata</i> (Diesing, 1863)	<i>Dasybatus walga</i>
<i>Tentacularia unionifactor</i> (Shipley & Hornell, 1904)	<i>Rhinoptera javanica</i> , <i>Dasybatus</i> sp, <i>Ginglymostoma concolor</i> Larvæ in the pearl oyster (<i>Margaritifera vulgaris</i>)

Genus III GYMNOTRICHUS Rudolphi, 1819

<i>Gymnotrichus gigas</i> (Cuvier, 1817)	<i>Dasybatus walga</i> Larvæ in <i>Hemigaleus balfour</i> , <i>Pristis cuspidatus</i> , <i>Cybrum guttatum</i> , <i>Chorinemus tolo</i> , <i>Arius gagora</i> , <i>Chirocentrus dorab</i> , <i>Trichurus savala</i> , <i>Serranus</i> sp, <i>Balistes</i> sp, <i>Lutjanus</i> sp, <i>Chupea ishha</i> , <i>Harpodon nehereus</i>
<i>Gymnotrichus malleus</i> (Linton, 1924)	<i>Pteroplatea micrura</i> , <i>Dasybatus kuhl</i>

Genus IV OTOBOTHEIUM Linton, 1890

(a) Adult worms

<i>Otobothrium linstowi</i> (Southwell, 1912)	<i>Pristis cuspidatus</i> , <i>Rhynchobatus djiddensis</i>
---	--

(b) Larval forms

<i>Otobothrium dypsacum</i> Linton, 1897.	<i>Diagramma crassispinum</i> , <i>Balistes mitis</i> , <i>Lethrinus ornatus</i> , <i>Lutjanus dodecakanthus</i> , <i>Serranus undulosus</i> .
<i>Otobothrium balli</i> Southwell, 1929 ..	<i>Cybrum guttatum</i> , <i>Lethrinus ornatus</i> , <i>Balistes stellatus</i> , <i>Aprion pristipoma</i>

Larval forms of uncertain generic position

Parasite	Host
<i>Tetrarhynchus</i> sp I Shipley & Hornell, 1906	<i>Cybium guttatum</i>
<i>Tetrarhynchus</i> sp II Shipley & Hornell, 1906	<i>Cybium guttatum</i>
<i>Tetrarhynchus</i> sp III Shipley & Hornell, 1906	<i>Chirocentrus dorab</i> , <i>Lutjanus annularis</i> , <i>Diagramma</i> sp, <i>Sphyræna commersoni</i>
<i>Tetrarhynchus</i> sp IV Meggitt, 1927	<i>Hurria rhynchops</i> (snake)
Plerocercoid larva (Southwell & Prashad, 1918)	<i>Clupea ihsha</i>
Plerocercoid larva Southwell, 1921	<i>Acromitus rabanchatu</i> (jellyfish)

Superfamily III PHYLLOBO'THRIODEA, nov

Family I PHYLLOBO'THRIIDÆ Braun, 1900

Genus I PHYLLOBO'THRIUM van Ben, 1850

- 1 *Phyllobothrium lactuca* van Ben, 1850 *Dasybatus kuhlī*, *D walga*, *Galeocercus arcticus*
- 2 *Phyllobothrium giganteum* van Ben, 1858 *Dasybatus walga*
- 3 *Phyllobothrium variabile* (Linton, 1889) *Dasybatus kuhlī*, *D walga*
- 4 *Phyllobothrium foliatum* Linton, 1890 *Rhynchobatus djiddensis*
- 5 *Phyllobothrium minutum* Shipley & Hornell, 1906 *Carcharias melanopterus*
- 6 *Phyllobothrium pangadi* (Shipley & Hornell, 1906) *Ætomylæus maculatus*, *Stoasodon narinari*
- 7 *Phyllobothrium lintoni* (Southwell, 1912) *Rhynchobatus djiddensis*, *Urogymnus asperrimus*
- 8 *Phyllobothrium floriforme* (Southwell, 1912) *Carcharias bleekeri*, *C sp*
- 9 *Phyllobothrium tumidum* Linton, 1922 *Hemigaleus balfouri*
- 10 *Phyllobothrium dagnalli* Southwell, 1927 *Rhina ancylostoma*, *Chiloscyllium indicum*, *Galeocercus arcticus*
- 11 *Phyllobothrium microsomum* Southwell & Hilmy, 1929 *Ginglymostoma concolor*
- 12 *Phyllobothrium gracile* Wedl, 1855 *Dasybatus* sp

Species inquirendæ

- 1 *Phyllobothrium pammacrum* Shipley & Hornell, 1906 *Carcharias melanopterus*
- 2 *Phyllobothrium blakei* Shipley & Hornell, 1906 *Dasybatus kuhlī*

Genus II. *ECHENEIBOTHRUM* van Ben, 1850

Parasite	Host
1 <i>Echeneibothrium minimum</i> van Ben, 1850	<i>Dasybatus walga</i> , <i>D. kuhli</i> , <i>Rhinoptera javanica</i> , <i>Carcharias</i> sp
2 <i>Echeneibothrium tumidulum</i> (Rud, 1819) van Ben, 1850	<i>Dasybatus walga</i>
3 <i>Echeneibothrium flexile</i> (Lanton, 1890)	<i>Dasybatus walga</i> , <i>D. uarnal</i>
4 <i>Echeneibothrium cancellatum</i> (Lanton, 1890)	<i>Rhinoptera javanica</i>
5 <i>Echeneibothrium trifidum</i> Shipley & Hornell, 1906	<i>Dasybatus walga</i>

Species inquirenda

<i>Echeneibothrium simplex</i> Shipley & Hornell, 1906	<i>Dasybatus walga</i>
--	------------------------

Genus III *MYZOPHYLLOBOTHRUM* Shipley & Hornell, 1906

<i>Myzophyllobothrium rubrum</i> Shipley & Hornell, 1906	<i>Stoasodon narinari</i> , <i>Aetomylæus maculatus</i>
--	---

Genus IV *CARPOBOTHRUM* Shipley & Hornell, 1906

<i>Carpobothrium chiloscylli</i> Shipley & Hornell, 1906	<i>Chiloscyllium indicum</i> , <i>Rhynchobatus djiddensis</i> , <i>Urogymnus asperimus</i>
--	--

Genus V *PITHOPHORUS* Southwell, 1925

<i>Pithophorus tetraglobus</i> (Southwell, 1911)	<i>Rhynchobatus djiddensis</i>
--	--------------------------------

Family II *ONCHOBOTHRIDÆ* Braun, 1900Genus I *ONCHOBOTHRUM* (Rud, 1819) Blainville, 1828

<i>Onchobothrium farmeri</i> (Southwell, 1911)	<i>Dasybatus kuhli</i>
--	------------------------

Genus II *ACANTHOBOTHRUM* van Ben, 1850

1 <i>Acanthobothrium coronatum</i> (Rud, 1819) van Ben, 1850	<i>Dasybatus kuhli</i> , <i>Carcharias</i> sp., <i>Urogymnus asperimus</i>
2 <i>Acanthobothrium uncinatum</i> (Rud, 1819) van Ben, 1850	<i>Dasybatus kuhli</i> , <i>D. walga</i>
3 <i>Acanthobothrium dujardini</i> van Ben, 1850	<i>Dasybatus walga</i> , <i>D. sephen</i>
4 <i>Acanthobothrium herdmani</i> Southwell, 1912	<i>Dasybatus kuhli</i>
5 <i>Acanthobothrium iyamai</i> Yoshida, 1917	<i>Narcine timplei</i> , <i>Chiloscyllium</i> sp.
6 <i>Acanthobothrium macracanthum</i> Southwell, 1925	<i>Urogymnus</i> sp., ? <i>asperimus</i>

Genus III *CALLIOBOTHRIUM* van Ben , 1850

Parasite

Host

- 1 *Calliobothrium verticillatum* (Rud., *Carcharias* sp 1819) van Ben , 1850
- 2 *Calliobothrium eschrichti* (van Ben , *Dasybatus sephen* 1850)

Genus IV *UNCIBILOCLARIS* Southwell, 1925

- 1 *Uncibilocularis trygonis* (Shipley *Dasybatus sephen*, *D walga* & Hornell, 1906)
- 2 *Uncibilocularis mandleyi* South- *Hemigaleus balfouri* well, 1927

Genus V *SPINIOCLUS* Southwell, 1925*Spiniloculus matensis**Chiloscyllum indicum*Genus VI *PLATYBOTHRIUM* Linton, 1890*Platybothrium cerinum* Linton, 1890 *Galeocerdo arcticus*Genus VII *PEDIBOTHRIUM* Linton, 1909

- 1 *Pedibothrium globicephalum* *Pristis cuspidatus*
Linton, 1909
- 2 *Pedibothrium longispine* Linton, *Chiloscyllum indicum*, *Galeocerdo*
1909 *arcticus*, *Rhina ancylostoma*
- 3 *Pedibothrium hutsoni* (Southwell, *Ginglymostoma concolor*, *Galeocerdo*
1911) *arcticus*, *Rhina ancylostoma*

Genus VIII *YORKERIA* Southwell, 1927*Yorkeria parva* Southwell, 1927*Chiloscyllum indicum*Genus IX *THYSANOCEPHALUM* Linton, 1889*Thysanocephalum crispum* (Linton, *Stoasodon narinari* 1889)

Larval forms

Scolex pleuronectis Mueller, 1788*Sardinella longiceps*Superfamily IV *LECANICEPHALOIDEA*, novFamily I *LECANICEPHALIDÆ* Braun, 1900Genus I. *LECANICEPHALUM* Linton, 1890*Lecanicephalum pellatum* Linton, *Pristis cuspidatus*, *Dasybatus kuhl*,
1890 *Pteroplatea micrura*Genus II *CEPHALOBOTHRIUM* Shipley & Hornell, 1906

- 1 *Cephalobothrium atobatidis* Shipley *Stoasodon narinari*, *Pteroplatea mic-*
& Hornell, 1906 *rura*, *Dasybatus kuhl*
- 2 *Cephalobothrium abruptum* South- *Dasybatus kuhl*, *Pteroplatea mic-*
well, 1911 *rura*
- 3 *Cephalobothrium variabile* South- *Pristis cuspidatus*, *Dasybatus kuhl*
well, 1911

Genus III TYLOCEPHALUM Linton, 1890

Parasite	Host
1 <i>Tylocephalum trygonis</i> Shipley & Hornell, 1905)	<i>Dasybatus walga</i> , <i>D</i> sp, ? <i>kuhl</i>
2 <i>Tylocephalum dierama</i> Shipley & Hornell, 1906	<i>Dasybatus kuhl</i> , <i>Rhynchobatus dyddensis</i> , <i>Rhinoptera javanica</i> , <i>Margaritifera vulgaris</i> (pearl oyster)
3 <i>Tylocephalum translucens</i> (Shipley & Hornell, 1906)	<i>Stoasodon narinari</i>
4 <i>Tylocephalum uarnak</i> Shipley & Hornell, 1906	<i>Dasybatus kuhl</i> , <i>D walga</i> , <i>D uarnak</i>
5 <i>Tylocephalum minutum</i> Southwell, 1925	<i>Urogymnus</i> sp, ? <i>asperrimus</i>
6 <i>Tylocephalum yorki</i> Southwell, 1925	<i>Stoasodon narinari</i>

Species inquirendæ

7 <i>Tylocephalum celobatidis</i> (Shipley & Hornell, 1905) Shipley & Hornell, 1906	<i>Dasybatus walga</i> , <i>Stoasodon narinari</i>
8 <i>Tylocephalum minus</i> Jameson, 1912	<i>Margaritifera vulgaris</i> (pearl oyster)

Genus IV ADELOBOTHRUM Shipley, 1900

<i>Adelobothrium celobatidis</i> Shipley, 1900	<i>Rhynchobatus dyddensis</i>
--	-------------------------------

Genus V BALANOBOTHRUM Hornell, 1912

1 <i>Balanobothrium tenax</i> Hornell, 1912	<i>Dasybatus walga</i> , <i>Stegostoma tigrinum</i>
2 <i>Balanobothrium parvum</i> Southwell, 1925	<i>Dasybatus</i> sp, <i>Galeocерdo arcticus</i>

Genus VI POLYPOCEPHALUS Braun, 1878

1 <i>Polypocephalus radiatus</i> Braun, 1878	<i>Dasybatus uarnak</i> , <i>D sephen</i> , <i>D kuhl</i>
2 <i>Polypocephalus pulcher</i> (Shipley & Hornell, 1906)	<i>Dasybatus sephen</i> .

Genus VII CALYCOBOTHRUM Southwell, 1911

<i>Calycobothrium typicum</i> (Southwell, 1911)	<i>Stoasodon narinari</i>
---	---------------------------

Genus VIII STAUROBOTHRUM Shipley & Hornell, 1905

<i>Staurobothrium celobatidis</i> Shipley & Hornell, 1905	<i>Stoasodon narinari</i> .
---	-----------------------------

Genera of uncertain systematic position, but possibly belonging to the family Lecanicephalidæ

Genus I ENIOCHOBOTHRUM Shipley & Hornell, 1906

Parasite	Host
<i>Eniochobothrium gracile</i> Shipley & Hornell, 1906	<i>Rhinoptera javanica</i>

Genus II DISCOBOTHRIUM van Ben, 1870

<i>Discobothrium cobraforme</i> (Shipley & Hornell, 1906)	<i>Stoasodon narinari</i>
---	---------------------------

Superfamily V PROTEOCEPHALOIDEA, nov

Family PROTEOCEPHALIDÆ La Rue, 1911

Genus I PROTEOCEPHALUS Weinland, 1858

- 1 *Proteocephalus shipleyi* (Lanstow, 1903) *Varanus (Hydrosaurus) salvator*.
- 2 *Proteocephalus punicus* (Cholod, 1908) Hall, 1910 *Paradoxurus hermaphroditus* (Malayan palm civet)
- 3 *Proteocephalus naia* (Beddard, 1913) *Naja tripudians*
- 4 *Proteocephalus monnigi* (Fuhrmann, 1924) Unidentified snake
- 5 *Proteocephalus beddardi* Woodland, 1925 *Varanus bengalensis*
- 6 *Proteocephalus tigrinus* Woodland, 1925 *Rana tigrina*
- 7 *Proteocephalus ritæ* Verma, 1926 *Rita rita*
- 8 *Proteocephalus woodlandi* Moghe, 1926 *Calotes versicolor*
- 9 *Proteocephalus fima* (Meggitt, 1927) *Rhabdophis stolatus*
- 10 *Proteocephalus fixus* (Meggitt, 1927) *Rhabdophis stolatus*
- 11 *Proteocephalus vitellaris* Verma, 1928 *Bagarius yarrelli* (= *Pimelodus bagarius*)

Species of uncertain identity

<i>Proteocephalus</i> sp Southwell, 1922	<i>Bungarus cœruleus</i>
<i>Proteocephalus</i> sp Meggitt, 1926	<i>Bungarus fasciatus</i>
<i>Proteocephalus</i> sp Meggitt, 1927	<i>Oligodon purpurescens</i>

Genus II GANGESIA Woodland, 1925

- 1 *Gangesia bengalensis* (Southwell, 1913) *Ophiocephalus striatus*, *Labeo rohita*, *Wallago attu*
- 2 *Gangesia macrones* Woodland, 1924 *Macrones seenghala*
- 3 *Gangesia pseudotropis* Verma, 1928 *Pseudotropis garua* (= *Silurus garua*)

Superfamily VI TÆNIOIDEA Zwicke, 1841

Family I TÆNIDÆ Ludwig, 1886

Genus TÆNIA Linnæus, 1758

Parasite	Host
1 <i>Tænia solium</i> Linnæus, 1858	Adult man Larva (Cysticercus cellulosæ) pig and man
2 <i>Tænia saginata</i> Goetze, 1782	Adult man Larva (Cysticercus bovis) cattle
3 <i>Tænia hydatigena</i> Pallas, 1766	Adult dogs Larva (Cysticercus tenuicollis) cattle, sheep, goats, and camels, the four horned antelope (<i>Tetracerus quadricornis</i>)
4 <i>Tænia echinococcus</i> (Zeder, 1803) Sicbold, 1853	Adult dogs Larva (hydatid cysts) cattle, horses, sheep, camels, and elephants
5 <i>Tænia pisiformis</i> Pallas, 1766	Adult dogs <i>Canis aureus</i> , <i>Felis tigris</i> , <i>F. leo</i> , <i>F. pardus</i> Larva (Cysticercus pisiformis) not recorded
6 <i>Tænia multiceps</i> Leske, 1780	Adult dogs, the jackal (<i>Canis aureus</i>), ? <i>Felis pardus</i> Larva (Cœnurus cerebralis) sheep, camels, and ? pigs
7 <i>Tænia tæniæformis</i> (Batsch, 1786) Wolf, 1911	Adult cats, <i>Felis viverrina</i> . Larva (Cysticercus fasciolaris) rats
8 <i>Tænia serialis</i> (Gervais, 1847)	Adult dogs Larva (Cœnurus serialis) not recorded
9 <i>Tænia ovis</i> (Cobbold, 1869) Ransom, 1913	Adult dogs Larva (Cysticercus ovis) not recorded
10 <i>Tænia retracta</i> Linstow, 1903	Adult <i>Canis echloni</i> (? <i>Vulpes ferrilatus</i>) Larva not recorded
11 <i>Tænia gaigeri</i> (Hall, 1916)	Adult dogs Larva (Cœnurus gaigeri) goats

Species inquirendæ

1 <i>Tænia meander</i> Linstow, 1903	Adult Schneider's leaf nosed bat (<i>Hipposidermus speoris</i>) Larva : not recorded
2 <i>Tænia</i> sp Linstow, 1906	Adult <i>Haliastur indus</i>
3 <i>Tænia</i> sp Southwell, 1922	Adult dogs
4 <i>Tænia</i> sp Southwell, 1922	Adult <i>Ursus torquatus</i>
5 <i>Tænia</i> sp (cystic form) Meggitt, 1927	Adult <i>Semnopithecus entellus</i>

Family II ANOPOLOCEPHALIDÆ Cholodkovsky, 1902

Subfamily 1 ANOPOLOCEPHALINÆ Fuhrmann, 1907

Genus I ANOPOLOCEPHALA E Blanchard, 1848

Parasite	Host
1 <i>Anoplocephala perfoliata</i> (Goeze, 1782)	Horses
2 <i>Anoplocephala magna</i> (Abildgaard, 1789)	Horses and donkeys
3 <i>Anoplocephala mamillana</i> (Mehlis, 1831)	Horses
4 <i>Anoplocephala gigantea</i> (Peters, 1856) R Blanchard, 1891	<i>Rhinoceros unicornis</i> , <i>R sondaicus</i>
5 <i>Anoplocephala manubriata</i> Railliet, Henry & Bouche, 1914	<i>Elephas maximus</i>
6. ? <i>Anoplocephala</i> sp Gaiger, 1915	Dogs

Genus II MONIEZIA Blanchard, 1891.

- | | |
|---|--|
| 1 <i>Moniezia expansa</i> (Rud , 1810) | Sheep, goat, ox, and camel, black-buck (<i>Antelope cervicapra</i>), four horned antelope (<i>Tetracerus quadricornis</i>) |
| 2 <i>Moniezia benedeni</i> (Moniez, 1879) Blanchard, 1891 | Sheep |

Genus III CITTOTÆMIA Riehm, 1881

- Cittotæmia pectinata* (Goeze, 1782) .. *Lepus ruficaudatus*, *L nigricollis*
(*Lepus ? hispidus*)

Genus IV BERTIELLA Stiles & Hassall, 1902

- Bertiella studeri* (Blanchard, 1891) Stiles & Hassall, 1902 *Simia satyrus*, *Hylobates hoolock*

Genus V APORINA Fuhrmann, 1902

- Aporina delafondi* (Railliet, 1892) Baer, 1927 Pigeons (*Columba* sp), *Platycercus pennanti*

Genus VI PARONIA Diamare, 1900

- Paronia columbæ* (Fuhrmann 1902) Fuhrmann, 1918 Pigeons

Subfamily 2 THYSANOSOMINÆ Fuhrmann, 1907

Genus I STILESIA Railliet, 1893

- | | |
|---|-----------------|
| 1 <i>Stilesia globipunctata</i> (Riv 1894) Railliet, 1893 | Sheep and goats |
| 2 <i>Stilesia vittata</i> Railliet, 1896 | Sheep |

Genus II AVITELLINA Gough, 1911

Parasite

Host

- 1 *Avitellina centripunctata* (Riv., 1874) (Railliet, 1893) Woodland, 1927 Goats
- 2 *Avitellina lahorea* Woodland, 1927 ? Sheep or goats
- 3 *Avitellina goughi* Woodland, 1927 Cattle, sheep, and goats

Subfamily 3 LINSTOWINÆ Fuhmann, 1907

Genus I LINSTOWIA Zschokke, 1899

Linstowia sp Southwell, 1922*Hemidactylus flaviviridis*

Genus II OCHORISTICA Luhe, 1898

- 1 *Oochoristica cryptobothria* (Linstow, 1906) La Rue, 1911 Tree snake (*Chrysopelea ornata*)
- 2 *Oochoristica agamæ* Baylis, 1919 . *Hemidactylus gleadowi*
- 3 *Oochoristica crassiceps* Baylis, 1920 *Calotes versicolor*
- 4 *Oochoristica amphisbelela* Meggitt, 1924 A mongoose (*Herpestes albopunctatus*) (? *auripunctatus*)
- 5 *Oochoristica sigmoides* Moghe, 1926 *Calotes versicolor*
- 6 *Oochoristica figurata* Meggitt, 1927 *Crocidura murina*
- 7 *Oochoristica fibrata* Meggitt, 1927 *Bomboa cyaneus*

Genus III THYSANOTÆNIA Beddard, 1911

Thysanotænium incognita Meggitt, 1927 *Macropus ruficollis*

Family III DAVAINÆIDÆ Fuhrmann, 1907

Subfamily 1 DAVAININÆ Braun, 1900

Genus I DAVAINA Blanchard, 1891

Davaina proglottina (Davaine, 1860) R Blanchard, 1891 The domestic fowl.

Genus II RAILLIETINA Fuhmann, 1920

Subgenus (a) Raillietina Stiles & Osleman, 1926
(= *Ransomia* Fuhmann, 1920)

- 1 *Raillietina* (R) *tetragona* (Molin, 1858) The domestic fowl, *Paro muticus*, *P cristatus*, *Francolinus vulgaris*.
- 2 *Raillietina* (R) *leptosoma* (Dies, 1850) *Platyercus eximius*
- 3 *Raillietina* (R) *friedbergieri* (Linstow, 1878) Fuhrmann, 1920 The black shouldered peacock (*Paro nigriceps*)
- 4 *Raillietina* (R) *celebensis* (Janicki, 1902) *Nesocia bengalensis*

Parasite	Host
5 <i>Railletina</i> (R) <i>microscolecina</i> Fuhrmann, 1909	A parrot (<i>Eclectus rosatus</i>) (= <i>Lorius loratus</i>), <i>Cacatua moluccensis</i>
6 <i>Railletina</i> (R) <i>aruensis</i> (Fuhr, 1911)	<i>Lorius lory</i>
7 <i>Railletina</i> (R) <i>cohni</i> Baczyńska, 1914	<i>Pterocles exustus</i> , <i>P. arenarius</i>
8 <i>Railletina</i> (R) <i>spiralis</i> (Baczyńska, 1914)	Pigeons (<i>Columba</i> sp), <i>Crocopus phænicopterus</i>
9 <i>Railletina</i> (R) <i>polychalix</i> Kotlán, 1920-21	<i>Lorius garrulus</i>
10 <i>Railletina</i> (R) <i>fuhrmanni</i> (Southwell, 1922)	<i>Crocopus phænicopterus</i> , <i>C. phayrei</i>
11 <i>Railletina</i> (R) <i>parvuncinata</i> Meggitt, 1924	Ducks
12 <i>Railletina</i> (R) <i>torquata</i> Meggitt, 1924	Pigeons (<i>Columba</i> sp)
13 <i>Railletina</i> (R) <i>nagpurensis</i> Moghe, 1925	The domestic pigeon
14 <i>Railletina</i> (R) <i>quadrtesticulata</i> Moghe, 1925	The red turtle dove (<i>Ænopopelia tranquebarica</i>)
15 <i>Railletina</i> (R) <i>flaccida</i> Meggitt, 1926	The imperial sand grouse (<i>Pterocles orientalis</i>)
16 <i>Railletina</i> (R) <i>famosa</i> Meggitt, 1927	<i>Eclectus pectoralis</i> (= <i>Lorius pectoralis</i>)
17 <i>Railletina</i> (R) <i>flabialis</i> Meggitt, 1927	<i>Dichoceros bicornis</i>
18 <i>Railletina</i> (R) <i>celebensis</i> var <i>paucicapsulata</i> Meggitt, 1927	<i>Rattus norvegicus</i> , <i>Nesocia bengalensis</i>
19 <i>Railletina</i> (R) <i>maplestoni</i> , n sp	A macaw

Subgenus (b) *Paroniella* Fuhrmann, 1920

1 <i>Railletina</i> (P) <i>urogalli</i> (Modeer, 1790) Fuhrmann, 1920	The partridge-pheasant (<i>Alectoris graeca chukar</i>)
2 <i>Railletina</i> (P) <i>cruciata</i> (Rud, 1819) —	The magpie (<i>Pica rustica</i>)
3 <i>Railletina</i> (P) <i>corvina</i> (Fuhr., 1905)	<i>Corvus macrorhynchus</i> , <i>C. splendens</i> , <i>C. sp</i>
4 <i>Railletina</i> (P) <i>ceylonica</i> (Baczyńska, 1914)	<i>Crocopus phænicopterus</i> , the white-bellied pigeon (<i>Columba leuconota</i>), <i>Pavo cristatus</i>
5 <i>Railletina</i> (P) <i>tragopani</i> (Southwell, 1922)	A tragopan pheasant
6 <i>Railletina</i> (P) <i>facilis</i> Meggitt, 1926	<i>Tragopan satyra</i>
7 <i>Railletina</i> (P) <i>contorta</i> Zschokke, 1895	The common Indian pangolin (<i>Manis pentadactyla</i>)

Subgenus (c) *Skrjabinia* Fuhrman, 1920

1 <i>Railletina</i> (S) <i>cesticillus</i> (Mohn, 1858)	The domestic fowl
2 <i>Railletina</i> (S) <i>centropi</i> Southwell, 1922)	The common caccal (<i>Centropus rufipennis</i>)

Subgenus (*d*) *Fuhimannetta* Stiles & Oileman, 1926
(=*Johnstonia* Fuhl, 1920)

Parasite	Host
1 <i>Railletina</i> (<i>F</i>) <i>echinobothrida</i> (Méglin, 1880)	The domestic fowl, the jungle fowl (<i>Gallus bankiva</i>), <i>Gallus ferrugineus</i>
2 <i>Railletina</i> (<i>F</i>) <i>birmanica</i> Meggitt, 1926	The domestic fowl
3 <i>Railletina</i> (<i>F</i>) <i>pseudoechino bothrida</i> Meggitt, 1926	The domestic fowl
4 <i>Railletina</i> (<i>F</i>) <i>lorkei</i> Joyeux & Houdemer, 1928	Pigeons

Species of *RAILLETINA* Fuhmann, 1920 Subgenus unknown

1 <i>Railletina</i> <i>analina</i> (Fuhrmann, 1909)	Pigeons (<i>Columba</i> sp.), the green pigeon (<i>Crocopus phœnicopterus</i>)
2 <i>Railletina</i> <i>reynoldsæ</i> Meggitt, 1926	<i>Corvus splendens insolens</i>
3 <i>Railletina</i> <i>fatalis</i> Meggitt, 1927	<i>Nesocia bengalensis</i> , <i>Rattus norvegicus</i>
4 <i>Railletina</i> <i>fluxa</i> Meggitt, 1927	<i>Rattus norvegicus</i>
5 <i>Railletina</i> <i>funebis</i> Meggitt, 1927	<i>Rattus norvegicus</i>
6 <i>Railletina</i> <i>indicus</i> Meggitt, 1927	<i>Nesocia bengalensis</i>
7 <i>Railletina</i> sp Southwell, 1922	Pigeons (<i>Columba</i> sp)
8 <i>Railletina</i> sp Southwell, 1922	Pigeons (<i>Columba</i> sp)
9 <i>Railletina</i> sp Southwell, 1922	Crow pheasant
10 <i>Railletina</i> sp Meggitt, 1926	<i>Gallus ferrugineus</i>
11 <i>Railletina</i> sp (? <i>paradisea</i> Fuhrmann, 1908)	Pigeons
12 <i>Railletina</i> spp Moghe, 1926	The domestic fowl, <i>Cypselus affinis</i> , <i>Turtur cambayensis</i>

Genus III *COTUGNIA* Diamale, 1893

1 <i>Cotugnia</i> <i>digonophora</i> (Pasquale, 1890)	Ducks, domestic fowl, and Somett's jungle fowl.
2 <i>Cotugnia</i> <i>fuhrmanni</i> Baczynska, 1914	<i>Pavo cristatus</i>
3 <i>Cotugnia</i> <i>brologerys</i> Meggitt, 1915	<i>Platycercus eximius</i>
4 <i>Cotugnia</i> <i>margareta</i> Beddard, 1916	Crows (<i>Corvus macrorhynchus</i>), a moonal pheasant (<i>Lophophorus refulgens</i>)
5 <i>Cotugnia</i> <i>fastigata</i> Meggitt, 1920	Domestic ducks, a parrot (? <i>Plistes coccineopterus</i>)
6 <i>Cotugnia</i> <i>cuneata</i> var <i>tenuis</i> Meggitt, 1924	Pigeons (<i>Columba</i> sp)
7 <i>Cotugnia</i> <i>cuneata</i> var <i>nervosa</i> Meggitt, 1924	Pigeons (<i>Columba</i> sp), red turtle-dove
8 <i>Cotugnia</i> <i>seni</i> Meggitt, 1926	<i>Platycercus eximius</i>

Subfamily 2 *OPHRYOCOTYLINÆ* Fuhrmann, 1907

Genus I *OPHRYOCOTYLE* Fries, 1870

<i>Ophryocotyle zeylanica</i> Linstow, 1906	The Ceylonese hornbill (<i>Lophoceros gingalensis</i>)
---	--

Family IV HYMENOLEPIDIDÆ Raillbet & Henry, 1909

Genus I. HYMENOLEPIS Weinland, 1858.

Parasite	Host
1 <i>Hymenolepis diminuta</i> (Rudolphi, 1819)	Rats
2 <i>Hymenolepis lanceolata</i> (Bloch, 1782) Weinland, 1858	The black Australian swan (<i>Chenopsis atrata</i>)
3 <i>Hymenolepis murina</i> (Dujardin, 1845) R. Blanchard, 1891	Rats, man
4 <i>Hymenolepis fusa</i> (Krabbe, 1869) Fuhrmann, 1906	<i>Larus brunneicephalus</i>
5 <i>Hymenolepis spinosa</i> Linstow, 1906	The painted snipe (<i>Rostratula capensis</i>)
6 <i>Hymenolepis septaria</i> Linstow, 1906	<i>Upupa ceylonensis</i>
7 <i>Hymenolepis clausa</i> Linstow, 1906	The whistling teal (<i>Dendrocygna javanica</i>)
8 <i>Hymenolepis rugosa</i> Clerc, 1906, var <i>birmanica</i> Meggitt, 1924	Pigeons (<i>Columba</i> sp.)
9 <i>Hymenolepis lempii</i> (Southwell, 1921) Mayhew, 1925	The little cormorant (<i>Phalacrocorax niger</i>)
10 <i>Hymenolepis farcinuosa</i> (Goeze, 1782)	<i>Corvus macrorhynchus</i> , <i>Acridotheres tristis</i> , <i>A. albocinctus</i>
11 <i>Hymenolepis gracilis</i> (Zeder, 1803) Cohn, 1901	<i>Crocopus phænicopterus</i> , the tufted duck (<i>Nyroca fulgula</i>), <i>Phænicopterus roseus</i> , domestic ducks
12 <i>Hymenolepis sphenocéphala</i> (Rudolphi, 1809) Fuhrmann, 1906	Pigeons (<i>Colomba</i> sp.)
13 <i>Hymenolepis coronula</i> (Dujardin, 1845) Cohn, 1901	Domestic ducks
14 <i>Hymenolepis liguloides</i> (Gervais, 1847)	The flamingo (<i>Phænicopterus roseus</i>).
15 <i>Hymenolepis furcata</i> (Stieda, 1862)	<i>Crocudura murina</i>
16 <i>Hymenolepis medici</i> (Stossich, 1890) Fuhrmann, 1906	<i>Pelicanus philippensis</i>
17 <i>Hymenolepis megalorchis</i> (Lühe, 1898)	The flamingo (<i>Phænicopterus roseus</i>).
18 <i>Hymenolepis simplex</i> Fuhrmann, 1906	<i>Tadorna cornuta</i>
19. <i>Hymenolepis zosteropsis</i> Fuhrmann, 1918	The white cheeked bulbul (<i>Criniger flaveolus</i>), the green magpie (<i>Cissa chinensis</i>), the eastern baya (<i>Ploceus passerinus</i>), the crested bunting (<i>Allophus melanicterus</i>), the tree pie (<i>Dendrocitta</i> sp.), the golden backed woodpecker (<i>Brachypternus aurantius</i>), the laughing thrush (<i>Trochalopteron meridionale</i>), the magpie (<i>Pica rustica</i>)
20 <i>Hymenolepis annandalei</i> Southwell, 1922	The black tailed godwit (<i>Limosa belgica</i>)

Parasite	Host
21. <i>Hymenolepis rustica</i> Meggitt, 1926	The domestic fowl
22. <i>Hymenolepis ficticia</i> Meggitt, 1927	The pelican
23. <i>Hymenolepis minutissima</i> Meggitt, 1927	<i>Crocodyra murina</i>
24. <i>Hymenolepis solitaria</i> Meggitt, 1927	<i>Crocodyra murina</i>
25. <i>Hymenolepis phalacrocorax</i> Wood-land, 1929	The large cormorant (<i>Phalacrocorax carbo</i>)
26. <i>Hymenolepis clerici</i> (Clerc, 1906) Fuhrmann, 1924	<i>Passer montanus</i>
27. <i>Hymenolepis capillaroides</i> Fuhrmann, 1906	Snipe

Doubtful species

<i>Hymenolepis</i> sp (? <i>collaris</i> Batsch, 1786) Fuhrmann, 1908 (= <i>H sinuosa</i> Cohn, 1901)	<i>Anas platyrhynchos</i>
<i>Hymenolepis fasciata</i> (Rud , 1810, ? Krabbe, 1869)	Ducks
<i>Hymenolepis</i> sp ? (<i>microcephala</i> Rud , 1819) Fuhrmann, 1906	The white stork (<i>Ciconia alba</i>)
<i>Hymenolepis</i> sp Gaiger, 1915	Dogs
<i>Hymenolepis</i> sp Southwell, 1916	The domestic fowl (<i>Gallus gallus</i> sp)
<i>Hymenolepis</i> sp Southwell 1916	The black Australian swan (<i>Chenopsis atrata</i>)
<i>Hymenolepis</i> sp Southwell, 1916	The woodpecker (<i>Chrysophlegma flavinucha</i>)
<i>Hymenolepis</i> sp (? <i>asymmetrica</i>) Fuhrmann 1918	The red billed blue magpie (<i>Urocissa occipitalis</i>)
<i>Hymenolepis</i> sp Southwell, 1922	<i>Emberiza luteola</i>
<i>Hymenolepis</i> sp Southwell, 1922	<i>Phalacrocorax carbo</i>
<i>Hymenolepis</i> sp Southwell, 1922	A magpie (<i>Copsychus saularis</i>)
<i>Hymenolepis</i> sp Southwell, 1922	Snipe
<i>Hymenolepis</i> sp (? <i>murina</i> or <i>diminuta</i>) Moghe, 1926	Rats
<i>Hymenolepis</i> sp Joyeux & Houdemer, 1928	Pigeons

Subgenus *Echinocotyle* Blanchard, 1891

- 1 *Echinocotyle rosseteri* Blanchard, 1891 Domestic ducks
- 2 *Echinocotyle uralensis* Clerc, 1902 Snipe (? *Capella* sp)

Genus II *FIMBRIARIA* Frohlich, 1802

- Fimbriaria fasciolaris* (Pallas, 1781) *Fuligula cristata* , domestic ducks
Wolff , 1900

Family V. DILEPIDIDÆ Railliet & Henry, 1909

Subfamily 1. DILEPIDINÆ Fuhrmann, 1907.

Genus I DILEPIS Weinland, 1858

Parasite	Host
1 <i>Dilepis campylancristota</i> (Wedl, 1855) Fuhrmann, 1908	Paddy-bird (<i>Herodias garzetta</i>), Pond heron (<i>Ardeola grayi</i>)
2 ? <i>Dilepis</i> sp	Tree pie (<i>Dendrocitta leucogaster</i>)

Genus II LATERIPORUS Fuhrmann, 1907

Lateriporus spinosus Fuhrmann, 1908 *Ardea purpurea*

Genus III CHOANOTÆNIA Railliet, 1896

- 1 *Choanotænia infundibuliformis* The domestic fowl
(Goeze, 1782) Railliet, 1896
2. *Choanotænia decacantha* Fuhrmann, 1913 Snipe (*Capella* sp.)
3. *Choanotænia barbara* Meggitt, 1926. *Passer montanus*
4. *Choanotænia galbulæ* (Zeder, 1803) Cohn, 1899 Crow (*Corvus splendens insolens*)
5. *Choanotænia magnicirrosa* Meggitt, 1926 *Acridotheres tristis*
6. *Choanotænia* sp Southwell, 1922.. *Totanus hypoleucos*

Genus IV ANOMOTÆNIA Cohn, 1900

- 1 *Anomotænia volvulus* (Linstow, 1906) Fuhrmann, 1908 The yellow-wattled lapwing (*Lobipluvia malabarica*)
- 2 *Anomotænia acollis* Fuhrmann, 1907 *Cuculus varius*
- 3 *Anomotænia* ? *constricta* (Molin, 1858) Cohn, 1906 Crows

Genus V AMÆBOTÆNIA Cohn, 1899

Amæbotænia sphenoides (Linstow, 1872) The domestic fowl (*Gallus ferrugineus*)

Genus VI PARVIROSTRUM Fuhrmann, 1907

Parvirostrum magnisomum, n sp A vulture

Genus VII GRYPORHYNCHUS Nordmann 1832

Gryporhynchus pusillus Nordmann, 1832 A pond heron (*Ardeola grayi*)

Genus VIII PENTORCHIS Meggitt, 1927

Pentorchis arctius Meggitt, 1927 *Ursus malayanus*

Genus IX DELTOCERAS Meggitt, 1927

Parasite

Host

Deltoceras ornithus Meggitt, 1927*Urocissa occipitalis*

Genus X CYCLOLORCHIDA Fuhrmann, 1907

Cyclorchida omalancristota (Wedl, A spoon bill (*Platalea* sp.). 1856), Fuhrmann, 1907

Subfamily 2 DIPYLIDIINAE Stiles, 1896

Genus I DIPYLIDIUM Leuckart, 1863

- 1 *Dipylidium caninum* (Linn, 1758) Cats and dogs, *Felis viverrina*, *Hyena striata*, a Himalayan palm civet (*Paradoxurus grayi*)
- 2 *Dipylidium gerlasi* Setti, 1895 *Felis viverrina*, a Malayan palm-civet (*Paradoxurus hermaphroditicus*)
- 3 *Dipylidium sexcoronatum* Ratz, Dogs
1900
- 4 *Dipylidium* sp Gaiger, 1915 Dogs

Genus II MONOPYLIDIUM Fuhrmann, 1899

Monopylidium chandleri Moghe, 1925 *Sarcogrammus indicus*.

Genus III SOUTHWELLIA Moghe, 1925

Southwellia gallinarum (Southwell, The domestic fowl 1921)

Genus IV PROCHOANOTÆNIA Meggitt, 1924

Prochoanotænia microsoma (Southwell, 1922) The eastern baya (*Ploceus atrigula*), the crested bunting (*Melophus melanicterus*)

Genus V MALIKA Woodland, 1929

Malika ædicnemus Woodland, 1929 The stone curlew (*Ædicnemus scolopax*)

Subfamily 3 PARUTERININAE Ransom, 1909

Genus I METROLIASTHES Ransom, 1900

Metroliastes lucida Ransom, 1900 The domestic fowl

Genus II RHABDOMETRA Cholodkovsky, 1906

- 1 *Rhabdometra tomica* Cholodkovsky, 1906 The painted partridge (*Francolinus pictus*)
- 2 *Rhabdometra dendrocitta* Woodland, 1929 *Dendrocitta rufa*

Family VI MESOCESTOIDIDÆ Fuhrmann, 1907

Genus I MESOCESTOIDES Vaillant, 1863.

Parasite.	Host
1 <i>Mesocestoides lineatus</i> (Goeze, 1782) <i>Felis tigris</i> , dogs Railliet, 1893	
2 <i>Mesocestoides mesorchis</i> Cameron, The Tibetan fox (<i>Vulpes ferrilatus</i>) 1925	

Larval Cestodes.

DITHYRIDIUM Rud, 1819 (=PIESTOCYSTIS Diesing, 1850).

1 Dithyridium sp Meggitt, 1927	<i>Rhabdophis stolatus</i>
2 Dithyridium sp Meggitt, 1927	<i>Dichoceros bicornis</i>
3 Dithyridium sp Meggitt, 1927	<i>Ophites jara</i>
4 Dithyridium sp Meggitt, 1927	<i>Bungarus multicinctus</i>
5 Dithyridium sp Meggitt, 1927	<i>Oligodon purpureus</i> .

Family VII NEMATOTÆNIIDÆ Luhe, 1910

Genus NEMATOTÆNIA Luhe, 1899.

? *Nematotænia dispar* (Goeze, 1782).. *Bufo melanostictus*, B sp

Family VIII AMABILIIDÆ Fuhrmann, 1908

Genus AMABILIA Diamare, 1893

Amabilia lamelligera (Owen, 1832, The flamingo (*Phænicopterus roseus*)
? 1835) Diamare, 1893

Family IX ACOLEIDÆ Ransom, 1909

Genus I DIPLOPOSTHE Jacobi, 1896

Diploposthe laevis (Bloch, 1782), *Netta rufina*, the tufted duck (*Nyroca fuligula*), *N ferina*, ? *Streptilas interpres*
Jacobi, 1896

Genus II GYROCÆLIA Fuhrmann, 1899

Gyrocaelia paradoxa (Linstow, 1906) The lesser sand plover (*Glareola lactea*=*Ægialitis mongolica*)
Fuhrmann, 1908

Family X TETRABOTHRIDÆ Linton, 1891.

Genus TETRABOTHRUS Rudolphi, 1819.

Tetrabothrus crostris (Lonnberg, *Sterna bergi*.
1889) Fuhrmann, 1899

Family XI DIÆCOCESTIDÆ, nov

Genus DIÆCOCESTUS Fuhrmann, 1900

Parasite	Host
<i>Diæcocestus novæ guineæ</i> Fuhrmann, 1914	The little grebe (<i>Podiceps albipennis</i>)

Genera of uncertain systematic position

Genus I ECHINOBOTHRUM van Beneden, 1850

- 1 *Echinobothrium typus* van Ben, *Stoasodon narinari*
1850
- 2 *Echinobothrium affine* Diesing, *Carcharias* sp, *Rhina halavi*
1863
- 3 *Echinobothrium rhinoptera* Shipley *Rhinoptera jaranica*
& Hornell, 1906
- 4 *Echinobothrium longicolle* Southwell, 1925 *Dasybatus kuhl*

Genus II PILLERSIA Southwell, 1927.

<i>Pillersia owen</i> Southwell, 1927	<i>Urogymnus asperrimus</i>
---------------------------------------	-----------------------------

Genus III DISCOCEPHALUM Linton, 1890

<i>Discocephalum pileatum</i> Linton, 1890	<i>Carcharias gangeticus</i>
--	------------------------------

Genus IV DIAGONOBOTHRUM Shipley & Hornell, 1906

<i>Diagonobothrium asymmetrum</i> Shipley & Hornell, 1906	<i>Ætomylæus maculatus</i>
---	----------------------------

Worms of uncertain identity

- | | |
|------------------------------|----------------------------------|
| 1 Cestoda sp Southwell, 1922 | <i>Loris gracilis</i> |
| 2 Cestoda sp Southwell, 1922 | <i>Sterna fluviatilis</i> |
| 3 Cestoda sp Meggitt, 1926 | <i>Corvus splendens insolens</i> |
| 4 Cestoda sp Moghe, 1926 | Unidentified snake |
| 5 ? Cysticerci Shipley, 1903 | <i>Cervus axis</i> |

CLASSIFIED LIST OF CESTODE HOSTS

PRIMATES	Man	<i>Tænia solium</i> , <i>T. saginata</i> , <i>Cysticercus cellulosæ</i> , <i>Hymenolepis murina</i> (= <i>H. nana</i>)
	<i>Simia satyrus</i>	<i>Bertiella studeri</i>
	<i>Semnopithecus entellus</i>	<i>Tænia</i> sp (larva)
	<i>Hylobates hoolock</i>	<i>Bertiella studeri</i>
CARNIVORA	Dogs	<i>Tænia hydatigena</i> , <i>T. pisiformis</i> , <i>T. ovis</i> , <i>T. multiceps</i> , <i>T. serialis</i> , <i>T. gasteri</i> , <i>T. echinococcus</i> , <i>Mesocostoides lineatus</i> , ? <i>Hymenolepis</i> sp, <i>Dipylidium caninum</i> , <i>D. sexcoronatum</i>
	Cats	<i>Tænia tæniæformis</i> , <i>Dipylidium caninum</i> , <i>Dibothriocephalus felis</i>
	<i>Felis viverrina</i>	<i>Tænia tæniæformis</i> , <i>Dipylidium caninum</i> , <i>D. geriaisi</i>
	<i>Felis tigris</i>	<i>Dibothriocephalus felis</i> , <i>Bothridium pithonis</i> , <i>Tænia pisiformis</i> , <i>Mesocostoides lineatus</i>
	<i>Felis leo</i>	<i>Tænia pisiformis</i>
	<i>Felis pardus</i>	<i>Dibothriocephalus felis</i> , <i>Tænia pisiformis</i>
	<i>Felis nebulosa</i>	<i>Dibothriocephalus felis</i>
	<i>Felis bengalensis</i>	<i>Dibothriocephalus</i> sp
	Black leopard (<i>Felis melas</i>)	<i>Dibothriocephalus</i> sp
	<i>Paradoxurus hermaproditicus</i>	<i>Proteocephalus punicus</i> , <i>Dipylidium geriaisi</i>
	<i>Paradoxurus grayi</i>	<i>Dipylidium caninum</i> , <i>Dibothriocephalus</i> sp
	<i>Herpestes auropunctatus</i>	<i>Oochoristica amphibeteta</i>
	<i>Herpestes albopunctatus</i> (= <i>auropunctatus</i>)	<i>Sparganum</i> sp
	<i>Hyæna striata</i>	<i>Dipylidium caninum</i>
	<i>Canis</i> sp	? <i>Anoplocephala</i> sp
	<i>Canis eiloni</i> (? <i>Vulpes ferrilatus</i>)	<i>Tænia retracta</i>
	<i>Canis aureus</i>	<i>Tænia pisiformis</i> , <i>T. multiceps</i>
	<i>Vulpes ferrilatus</i>	<i>Mesocostoides mesorchis</i>
	<i>Ursus torquatus</i>	<i>Tænia</i> sp
	<i>Ursus malayanus</i>	<i>Pentorchis arctus</i>
	<i>Paradoxurus hermaproditus</i>	<i>Proteocephalus punicus</i>
INSECTIVORA	<i>Crocodyrus murina</i>	<i>Oochoristica figurata</i> , <i>Hymenolepis solitaria</i> , <i>H. minutissima</i>

CHIROPTERA	<i>Hipposiderus speoris</i>	<i>Tænia meander</i>
RODENTIA	<i>Rattus norvegicus</i>	<i>Raillietina</i> (R) <i>celebensis</i> var <i>paucicapsulata</i> , <i>R fatalis</i> , <i>R flura</i> , <i>R funebris</i>
	<i>Nesocia bengalensis</i>	<i>Raillietina</i> (R) <i>celebensis</i> var <i>paucicapsulata</i> , <i>R fatalis</i> , <i>R indica</i>
	Rats	<i>Cysticercus fasciolaris</i> , <i>Hymenolepis diminuta</i> , <i>H murina</i>
	<i>Lepus ruficaudatus</i>	<i>Cittotænia pectinata</i>
	<i>Lepus nigricollis</i>	<i>Cittotænia pectinata</i>
	<i>Lepus</i> ? <i>hispidus</i>	<i>Cittotænia pectinata</i>
UNGULATA	<i>Elephas maximus</i>	<i>Anoplocephala manubriata</i>
	<i>Equus caballus</i>	<i>Anoplocephala perfoliata</i> , <i>A magna</i> , <i>A mamillana</i> , <i>Echinococcus</i> (larva)
	<i>Equus hemionus</i>	<i>Anoplocephala magna</i>
	<i>Rhinoceros unicornis</i>	<i>Anoplocephala gigantea</i>
	<i>Rhinoceros sondaicus</i>	<i>Anoplocephala gigantea</i>
	Ox	<i>Moniezia expansa</i> , <i>Avitellina goughi</i> , <i>Cysticercus bovis</i> , <i>Cysticercus tenuicollis</i> , <i>Echinococcus</i> (larva)
	<i>Bos grunniens</i>	<i>Moniezia</i> sp
	Sheep	<i>Moniezia benedeni</i> , <i>Stilesia globipunctata</i> , <i>S vittata</i> , <i>Avitellina goughi</i> , <i>Cysticercus tenuicollis</i> , <i>Cœnurus cerebralis</i> , <i>Echinococcus</i> (larva)
	Sheep or goat	<i>Avitellina lahorea</i>
	Goat	<i>Moniezia expansa</i> , <i>Stilesia globipunctata</i> , <i>Avitellina centripunctata</i> , <i>A goughi</i> , <i>Cysticercus tenuicollis</i> , <i>Cœnurus</i>
	<i>Antelope cervicapra</i>	<i>Moniezia expansa</i>
	<i>Tetracerus quadricornis</i>	<i>Moniezia expansa</i> , <i>Cysticercus tenuicollis</i>
	Camel	<i>Moniezia expansa</i> , <i>Cysticercus tenuicollis</i> , <i>Echinococcus</i> (larva)
	Pig	<i>Cysticercus cellulosæ</i>
	? <i>Sus cristatus</i>	<i>Cœnurus cerebralis</i>
EDENTATA	<i>Marmos pentadactyla</i>	<i>Raillietina</i> (P) <i>contorta</i>
MARSUPIALS.	<i>Macropus ruficollis</i>	<i>Thysanotænia incognita</i>
BIRDS	<i>Urocissa occipitalis</i>	<i>Deltoceas ornithus</i> , <i>Hymenolepis</i> sp (? <i>asymmetrica</i>)
Order I		
PASSERES	<i>Ploceus atrigula</i>	<i>Prochoanotænia microsoma</i>
	<i>Ploceus passerinus</i> ...	<i>Hymenolepis zosteropsis</i>
	<i>Passer montanus</i>	<i>Hymenolepis clerici</i> , <i>Choanotænia barbara</i>

BIRDS (cont)	<i>Dendrocitta leucogaster</i>	<i>Dilepis</i> sp
Order I	<i>Dendrocitta rufa</i>	<i>Rhabdometra dendrocitta</i>
PASSERES	<i>Dendrocitta</i> spp	<i>Hymenolepis zosteropsis</i> , <i>Hymenolepis</i> sp
(cont)	<i>Corvus splendens in solens</i>	<i>Choanotænia galbulæ</i> , <i>Raillietina reynoldsæ</i>
	<i>Corvus splendens</i>	<i>Raillietina</i> (P) <i>corvina</i>
	<i>Corvus macrorhynchus</i>	<i>Hymenolepis farciminosa</i> , <i>Raillietina</i> (P) <i>corvina</i> , <i>Cotugnia margareta</i>
	<i>Corvus</i> sp	<i>Raillietina</i> (P) <i>corvina</i>
	Finch	<i>Choanotænia barbara</i>
	<i>Acridotheres tristis</i>	<i>Choanotænia magnicirrosa</i> , <i>Hymenolepis farciminosa</i>
	<i>Acridotheres albocinctus</i>	<i>Hymenolepis farciminosa</i>
	Crow	<i>Anomotænia</i> ? <i>constricta</i>
	<i>Criniger flaveolus</i>	<i>Hymenolepis zosteropsis</i>
	<i>Cissa chinensis</i>	<i>Hymenolepis zosteropsis</i>
	<i>Trocalopterum meridionale</i>	<i>Hymenolepis zosteropsis</i>
	<i>Pica rustica</i>	<i>Hymenolepis sphenocephala</i> , <i>Raillietina</i> (P) <i>cruciata</i>
	<i>Copsychus saularis</i>	<i>Hymenolepis</i> sp
	<i>Emberiza luteola</i>	<i>Hymenolepis</i> sp
	<i>Cypselus affinis</i>	<i>Raillietina</i> sp
Order II	<i>Dichoceros bicornis</i>	<i>Sparganum</i> sp
CORACIFORMES	<i>Dichoceros bicornis</i>	<i>Dithyridium</i> sp II, <i>Raillietina</i> (R) <i>flabialis</i>
	<i>Cuculus varius</i>	<i>Anomotænia acollis</i>
	<i>Brachypternus auran-tius</i>	<i>Hymenolepis zosteropsis</i>
	<i>Upupa ceylonensis</i>	<i>Hymenolepis septaria</i>
	<i>Chrysophlegma flavinucha</i>	<i>Hymenolepis</i> sp
	<i>Centropus rufipennis</i>	<i>Raillietina</i> (S) <i>centropi</i>
	<i>Lophoceros gingalensis</i>	<i>Ophryocotyle zeylanica</i>
Order III	<i>Halastur indus</i>	<i>Tænia</i> sp
ACCIPITRES	Vulture	<i>Parvirostrum magnisomum</i>
Order IV	Pigeon	<i>Hymenolepis</i> sp, <i>Raillietina</i> (R) <i>spiralis</i> , <i>Raillietina</i> (R) <i>nagpurensis</i> , <i>Raillietina</i> (F) <i>korkei</i>
COLUMBÆ	<i>Columba leuconota</i>	<i>Raillietina</i> (P) <i>ceylonica</i>
	<i>Columba</i> spp	<i>Aporina delafondi</i> , <i>Parona columbæ</i> , <i>Hymenolepis sphenocephala</i> , <i>H rugosa</i> , <i>Raillietina anatina</i> , <i>Raillietina</i> sp, <i>Raillietina</i> sp (? <i>paradisea</i>), <i>Raillietina</i> (R) <i>torquata</i> , <i>Cotugnia cuneata</i> var <i>tenuis</i> , <i>C cuneata</i> var <i>nervosa</i>

BIRDS (cont)	<i>Crocopus phænicoplerus</i>	<i>Hymenolepis gracilis</i> , <i>Railletina</i> (R) <i>spiralis</i> , <i>Railletina</i> (R) <i>fuhrmanni</i> , <i>Railletina</i> (P) <i>ceylonica</i> , <i>R anatina</i>
Order IV	<i>Crocopus phayrei</i>	<i>Railletina</i> (R) <i>fuhrmanni</i>
COLUMBÆ	<i>Œnopuselia tranquebarica</i>	<i>Railletina</i> (R) <i>quadrilesticulata</i>
(cont)	<i>Turtur cambayensis</i>	<i>Railletina</i> sp
Order V	<i>Platycercus pennanti</i>	<i>Aporina delafondi</i>
PSITTACITORMES	<i>Platycercus eximius</i>	<i>Railletina</i> (R) <i>leptosoma</i> , <i>Cotugnia brotogeris</i> , <i>C seni</i>
	<i>Eclectus rosalia</i> (= <i>Lorius rosalus</i>)	<i>Railletina</i> (R) <i>microscolicina</i>
	<i>Eclectus pectoralis</i> (= <i>Lorius pectoralis</i>)	<i>Railletina</i> (R) <i>famosa</i>
	<i>Cacatua moluccensis</i>	<i>Railletina</i> (R) <i>microscolicina</i>
	<i>Lorius lory</i>	<i>Railletina</i> (R) <i>aruensis</i>
	<i>Lorius garrulus</i>	<i>Railletina</i> (R) <i>polychalis</i>
	<i>Ptilines coccineopterus</i>	<i>Cotugnia fastigata</i>
	<i>A macaw</i>	<i>Railletina</i> (R) <i>maplestonei</i> , n sp
Order VI	<i>Pterocles exustus</i>	<i>Railletina</i> (R) <i>cohnii</i>
PTEROCLETES	<i>Pterocles arenarius</i>	<i>Railletina</i> (R) <i>cohnii</i>
	<i>Pterocles orientalis</i>	<i>Railletina</i> (R) <i>flaccida</i>
Order VII	Domestic fowl	<i>Choanotania infundibuliformis</i> , <i>Hymenolepis rustica</i> , <i>Southwellia gallinarum</i> , <i>Metrosthes lucida</i> , <i>Railletina</i> (R) <i>tetragona</i> , <i>Amæbotania sphenoides</i> , <i>Dalmanea proglottina</i> , <i>Railletina</i> (S) <i>cesticillus</i> , <i>R</i> (F) <i>echinobothrida</i> , <i>R</i> (F) <i>birmanica</i> , <i>R</i> (F) <i>pseudo-echinobothrida</i> , <i>Cotugnia digonophora</i>
GALLINÆ	<i>Gallus ferrugineus</i>	<i>Amæbotania sphenoides</i> , <i>Railletina</i> (F) <i>echinobothrida</i> , <i>Railletina</i> sp
	<i>Gallus sonnerati</i>	<i>Railletina</i> (S) <i>cesticillus</i>
	<i>Gallus banila</i>	<i>Railletina</i> (F) <i>echinobothrida</i>
	<i>Gallus</i> sp	<i>Hymenolepis</i> sp
	<i>Francolinus pictus</i>	<i>Rhabdometra lomica</i>
	<i>Francolinus vulgaris</i>	<i>Railletina</i> (R) <i>tetragona</i>
	<i>Pavo muticus</i>	<i>Railletina</i> (R) <i>tetragona</i>
	<i>Pavo cristatus</i>	<i>Railletina</i> (R) <i>tetragona</i> , <i>R</i> (P) <i>ceylonica</i> , <i>Cotugnia fuhrmanni</i>
	<i>Pavo nigripennis</i>	<i>Railletina</i> (R) <i>friedbergi</i>
	<i>Alectoris græca</i>	<i>Railletina</i> (P) <i>urogalli</i>
	Crow pheasant	<i>Railletina</i> sp
	<i>Tragopan</i> sp	<i>Railletina</i> (P) <i>tragopani</i>
	<i>Tragopan satyra</i>	<i>Railletina</i> (P) <i>facilis</i>
	Sommet's jungle fowl.	<i>Cotugnia digonophora</i>
	<i>Lophophorus refulgens</i>	<i>Cotugnia margareta</i>

BIRDS (cont) Order VIII GRALLÆ	<i>Rostratula capensis</i>	<i>Hymenolepis spinosa</i>
Order IX CHARADRIIFORMES	<i>Sarcogrammus indicus</i>	<i>Monopygidium chandleri</i>
	Snipe (<i>Capella</i> sp)	<i>Hymenolepis capillaroides</i> , <i>Echinocotyle uralensis</i> , <i>Choanotænia decacantha</i>
	Snipe	<i>Hymenolepis</i> sp
	<i>Totanus hypoleucus</i>	<i>Choanotænia</i> sp
	<i>Lobipluvia malabarica</i>	<i>Anomotænia volvulus</i>
	<i>Limosa belgica</i>	<i>Hymenolepis annandalei</i>
	<i>Larus brunneicephalus</i>	<i>Hymenolepis fusa</i>
	<i>Œdicnemus scolopax</i> .	<i>Malika œdicnemus</i>
	? <i>Streptilas interpres</i> .	<i>Diploposthe lævis</i>
	<i>Glareola lactea</i> (= <i>Ægialitis mongolica</i>)	<i>Gyrocelia paradoxa</i>
	<i>Sterna bergi</i>	<i>Tetrabothrius erostris</i>
Order X STEGANOPODES	<i>Pelicanus philippensis</i>	<i>Hymenolepis medici</i>
	Pelican	<i>Hymenolepis ficticia</i>
	<i>Phalacrocorax niger</i>	<i>Hymenolepis lempii</i>
	<i>Phalacrocorax carbo</i>	<i>Hymenolepis</i> sp, <i>Hymenolepis phalacrocorax</i>
Order XI HERODIONES	<i>Platalea</i> sp	<i>Cyclorchida omalancristrola</i>
	<i>Herodias garzetta</i>	<i>Dilepis campylancristrola</i>
	<i>Ardeola grayi</i>	<i>Dilepis campylancristrola</i> , <i>Gryporhynchus pusillus</i>
	<i>Ardea purpurea</i>	<i>Lateriporus spinosus</i>
	<i>Ciconia alba</i>	<i>Hymenolepis</i> ? <i>microcephala</i>
Order XII PHÆNICOPTERI	<i>Phænicopterus roseus</i>	<i>Hymenolepis liguloides</i> , <i>H megaorchis</i> , <i>H gracilis</i> , <i>Amabilia lamelligera</i>
Order XIII ANSERES	Domestic ducks	<i>Echinocotyle rooseleti</i> , <i>Fimbriaria fasciolaris</i> , <i>Hymenolepis sphenoccephala</i> , <i>H coronula</i> , <i>H</i> ? <i>fasciata</i> , <i>H gracilis</i> , <i>Railletina</i> (R) <i>parvuncinata</i> , <i>Cotugna digonophora</i> , <i>C fastigata</i>
	<i>Fuligula cristata</i>	<i>Fimbriaria fasciolaris</i>
	<i>Tadorna cornuta</i>	<i>Hymenolepis simplex</i>
	<i>Anas pæcilorhynchus</i>	<i>Hymenolepis</i> sp (? <i>collaris</i>)
	<i>Chenopsis atrata</i>	<i>Hymenolepis lanceolata</i> , <i>Hymenolepis</i> sp
	<i>Dendrocygna javanica</i>	<i>Hymenolepis clausa</i>
	<i>Nyroca fuligula</i>	<i>Hymenolepis gracilis</i> , <i>Diploposthe lævis</i>
	<i>Nyroca baeri</i>	<i>Diploposthe lævis</i>
	<i>Nyroca ferina</i>	<i>Diploposthe lævis</i>
	<i>Netta rufina</i>	<i>Diploposthe lævis</i>
Order XIV. PYGOPODES	<i>Podiceps albipennis</i>	<i>Diæcocestus novæ guineæ</i>

REPTILES
SQUAMATA

<i>Hemidactylus flaviviridis</i>	<i>Linstownia</i> sp
<i>Hemidactylus gleadowi</i>	<i>Oochoristica agama</i>
<i>Calotes versicolor</i>	<i>Oochoristica crassiceps</i> , <i>O. sigmoides</i> , <i>Proteocephalus woodlandi</i>
<i>Chrysopelea ornata</i>	<i>Oochoristica cryptobothrium</i>
<i>Rhabdophis stolatus</i>	<i>Dithyridium</i> sp I, <i>Proteocephalus fina</i> , <i>P. fixus</i>
<i>Ophites jara</i>	<i>Dithyridium</i> sp III
<i>Bungarus multicinctus</i>	<i>Dithyridium</i> sp IV
<i>Bungarus caeruleus</i>	<i>Proteocephalus</i> sp
<i>Bungarus fasciatus</i>	<i>Proteocephalus</i> sp
<i>Oligodon purpureescens</i>	<i>Dithyridium</i> sp V, <i>Proteocephalus</i> sp
<i>Boiga cyaneus</i>	<i>Oochoristica fibrata</i>
<i>Python reticularis</i>	<i>Bothridium pythonis</i>
<i>Python molurus</i>	<i>Bothridium pythonis</i>
<i>Tropidonotus</i> sp	<i>Dibothriocephalus reptans</i>
<i>Varanus bengalensis</i>	<i>Duthiersia fimbriata</i> , <i>Proteocephalus beddardi</i>
<i>Varanus exacanthematicus</i>	<i>Duthiersia fimbriata</i>
<i>Varanus salinator</i>	<i>Proteocephalus shipleyi</i>
<i>Varanus</i> sp	<i>Duthiersia fimbriata</i>
<i>Naja tripudians</i>	<i>Proteocephalus naja</i>
<i>Hieria rhynchops</i>	<i>Tetrarhynchus</i> sp IV
Unidentified snake	<i>Proteocephalus monnigi</i>

AMPHIBIANS
ECAUDATA

<i>Rana tigrina</i>	<i>Dibothriocephalus ranarum</i> , <i>Proteocephalus tigrinus</i>
<i>Bufo melanostictus</i>	<i>Nematotænia dispar</i>

FISHES
CARCHARIIDÆ

<i>Carcharias gangeticus</i>	<i>Tentacularia gangeticus</i> , <i>T. ilisha</i> , <i>Tetrarhynchus perideræus</i> , <i>Discoccephalum pileatum</i>
<i>Carcharias melanopterus</i>	<i>Tentacularia carcharidis</i> , <i>Phyllobothrium minutum</i> , <i>P. pamicrum</i>
<i>Carcharias bleekeri</i>	<i>Phyllobothrium floriforme</i>
<i>Carcharias</i> spp	<i>Tentacularia minuta</i> , <i>Acanthobothrium coronatum</i> , <i>Calliobothrium verticillatum</i> , <i>Echinobothrium minimum</i> , <i>Phyllobothrium floriforme</i> , <i>Echinobothrium affine</i>
<i>Hemigaleus balfouri</i>	<i>Gymnorhynchus gigas</i> , <i>Uncibilocularis mandleyi</i> , <i>Phyllobothrium tumidum</i>
<i>Galeocerdo arcticus</i>	<i>Tentacularia macropora</i> , <i>Platybothrium cerium</i> , <i>Pedibothrium longispine</i> , <i>P. huttoni</i> , <i>Phyllobothrium lactuca</i> , <i>P. agnelli</i> , <i>Balanctosium primum</i>

FISHES (cont.)

SCYLLIDÆ

- Ginglymostoma concolor* *Tentaculania unionifactor*, *Tetrarhynchus peridericus*, *T. shipleyi*, *T. ceylonicus*, *T. matheri*, *Pedibothrium hutsoni*, *Phyllobothrium macrosomum*
- Stegosoma tigrinum* *Tentaculania macropora*, *Balanobothrium tenax*
- Chiloscyllium indicum* *Pedibothrium longispine*, *Yorkina parva*, *Phyllobothrium dagnalli*, *Carpobothrium chiloscylli*, *Spiniloculus marenensis*
- Chiloscyllium* sp. *Acanthobothrium yima*

PRISTIDÆ

- Pristis cuspidatus* *Gymnorhynchus gigas*, *Otobothrium linstowi*, *Pedibothrium globicephalum*, *Iecanicephalum pellatum*, *Cephalobothrium variabile*

RHINOBATIDÆ

- Rhynchobatus djiddensis* *Tentaculania macrocephala*, *T. rhynchobatidis*, *T. leucomelana*, *T. spinulifera*, *T. rossi*, *T. michie*, *Tetrarhynchus herdmanni*, *Otobothrium linstowi*, *Adelobothrium acetabulidis*, *Carpobothrium chiloscylli*, *Pythophorus tetraglobus*, *Phyllobothrium foliatum*, *P. lintoni*, *Tylocephalum dierama*
- Rhina ancylostoma* *Pedibothrium longispine*, *P. hutsoni*, *Phyllobothrium dagnalli*
- Rhina halarg* *Tentaculania minuta*, *Echinobothrium affine*

TORPEDINIDÆ

- Narcine timleri* *Acanthobothrium yima*

DASYBATIDÆ

- Urogymnus asperimus* *Acanthobothrium coronatum*, *Phyllobothrium lintoni*, *Carpobothrium chiloscylli*, *Puliersia oweni*
- Urogymnus* sp. ? *Acanthobothrium macracanthum*, *Tylocephalum minutum*
- Dasybatus kuhli* *Tentaculania macrocephala*, *T. leucomelana*, *T. rossi*, *T. michie*, *Gymnorhynchus malleus*, *Onchobothrium farmeri*, *Acanthobothrium coronatum*, *A. uncinatum*, *A. herdmanni*, *Phyllobothrium lactuca*, *P. blakeri*, *P. variabile*, *Echinobothrium minimum*, *Iecanicephalum pellatum*, *Cephalobothrium acetabulidis*, *C. abruptum*, *C. variabile*, *Tylocephalum dierama*, *T. uarnah*, *Polypocephalus radiatus*, *Echinobothrium longicollis*
- Dasybatus* sp. (? *kuhli*) *Tylocephalum trygonis*

FISHES (cont.)

DASYBATIDÆ
(cont.)

- Dasybatus sephen* *Tentacularia leucomelana*, *T. johnstoni*, *T. michuæ*, *T. obesa*, *Acanthobothrium dujardi*, *Calliobothrium eschrichti*, *Uncibilocularis trygonis*, *Polypocephalus radiatus*, *P. pulcher*
- Dasybatus uarnak* *Tentacularia macropora*, *Echeneiobothrium flexile*, *Tylocephalum uarnak*, *Polypocephalus radiatus*
- Dasybatus walga* *Tentacularia longispina*, *T. macrocephala*, *T. rossi*, *T. rubro maculata*, *Tetrarhynchus eque-dentatus*, *T. herdmanni*, *Gymnorhynchus gigas*, *Acanthobothrium uncinatum*, *A. dujardi*, *Uncibilocularis trygonis*, *Phyllobothrium lactuca*, *P. giganteum*, *P. variabile*, *Echeneiobothrium minimum*, *E. flexile*, *E. trifidum*, *E. simplex*, *E. tumidulum*, *Tylocephalum trygonis*, *T. uarnak*, *T. atobatidis*, *Balanobothrium tenax*
- Dasybatus* sp. (? *walga*) *Tentacularia binunca*, *T. unionifactor*
- Dasybatus* sp. *Tentacularia macropora*, *Balanobothrium parvum*, *Phyllobothrium gracile*
- Tacnura melanospila* *Tetrarhynchus minimus*
- Pteroplatea micrura* *Gymnorhynchus malleus*, *Lecani-cephalum pellatum*, *Cephalobothrium atobatidis*, *C. abruptum*

MYLIOBATIDÆ

- Etomylæus maculatus* *Phyllobothrium pangaïi*, *Myzophyllobothrium rubrum*, *Diagonobothrium asymmetrum*
- Rhinoptera javanica* *Tentacularia unionifactor*, *Echeneiobothrium minimum*, *E. cancellatum*, *Tylocephalum dierama*, *Echinochobothrium gracile*, *E. rhinoptera*
- Stoasodon narinari* *Tentacularia atobatidis*, *T. rossi*, *Thysanocephalum crispum*, *Phyllobothrium pangaïi*, *Myzophyllobothrium rubrum*, *Cephalobothrium atobatidis*, *Tylocephalum translucens*, *T. yonlei*, *T. atobatidis*, *Calycobothrium typicum*, *Staurobethrium atobatidis*, *Discobothrium cobraforme*, *Echinobothrium typus*

SILURIDÆ

- Clarias batrachus* *Caryophyllæus indicus*
- Macrones aor* *Amphilina paraquonopora*

FISHES (cont.)

SILURIDÆ (cont.)	<i>Macrones seenghala</i>	<i>Amphilina paragonopora</i> , <i>Gangesia macrones</i>
	<i>Rita rita</i>	<i>Proteocephalus rita</i>
	<i>Arius gogora</i>	<i>Gymnorhynchus gigas</i>
	<i>Barganus yaricelli</i>	<i>Proteocephalus utellaris</i> , <i>Amphilina paragonopora</i>
	<i>Wallago attu</i>	<i>Gangesia bengalensis</i>
	<i>Pseudentropius garua</i>	<i>Gangesia pseudentropii</i>
OPHTHOCEPHALIDÆ	<i>Ophiocephalus striatus</i>	<i>Ancistrocephalus</i> sp., <i>Gangesia bengalensis</i>
	<i>Ophiocephalus marulius</i>	<i>Bothriocephalus pycnomerus</i>
CYPRINIDÆ	<i>Labeo rohita</i>	<i>Ligula intestinalis</i> , <i>Ancistrocephalus</i> sp., <i>Gangesia bengalensis</i>
	<i>Labeo calbasu</i>	<i>Ligula intestinalis</i>
	<i>Nemachilus rupicola</i>	<i>Ligula intestinalis</i>
	<i>Rabara dariconius</i>	<i>Ligula</i> sp
CHIROCENTRIDÆ	<i>Chirocentrus dorab</i>	<i>Gymnorhynchus gigas</i> , <i>Tetrarhynchus</i> sp. III
CLUPEIDÆ	<i>Sardinella longiceps</i>	<i>Scolex pleuronectis</i>
	<i>Clupea ulsha</i>	<i>Tentacularia ulsha</i> , <i>Gymnorhynchus gigas</i> , <i>Pterocercoid</i> larvæ
SCOPELIDÆ	<i>Harpodon nehereus</i>	<i>Gymnorhynchus gigas</i>
PERCIDÆ	<i>Serranus undulosus</i>	<i>Tentacularia macfieii</i> , <i>T. pillersi</i> , <i>Otobothrium dipsacum</i>
	<i>Serranus</i> sp	<i>Gymnorhynchus gigas</i>
	<i>Lutjanus argenti-maculatus</i>	<i>Tentacularia macfieii</i> , <i>T. pillersi</i> .
	<i>Lutjanus gibbus</i>	<i>Tentacularia macfieii</i>
	<i>Lutjanus dodecakanthus</i>	<i>Otobothrium dipsacum</i>
	<i>Lutjanus annularis</i>	<i>Tetrarhynchus</i> sp. III
	<i>Lutjanus</i> sp	<i>Gymnorhynchus gigas</i>
	<i>Apriou pristipoma</i>	<i>Otobothrium balli</i>
	<i>Diagramma crassispinum</i>	<i>Otobothrium dipsacum</i> , <i>Amphilina magna</i>
	<i>Diagramma</i> sp	<i>Tentacularia pillersi</i> , <i>Tetrarhynchus</i> sp. III
	<i>Histiophorus</i> sp	<i>Bothriocephalus histiophorus</i>
	<i>Drepane punctata</i>	<i>Tentacularia pillersi</i>
SQUAMIPINNES	<i>Lethinus ornatus</i>	<i>Otobothrium dipsacum</i> , <i>O. balli</i>
TRICHIURIDÆ.	<i>Chorinemus lysan</i>	<i>Tentacularia macfieii</i>
	<i>Chorinemus tolo</i>	<i>Tentacularia macfieii</i> , <i>Gymnorhynchus gigas</i>
	<i>Trichurus savala</i>	<i>Tentacularia macfieii</i> , <i>Gymnorhynchus gigas</i>

FISHES (cont.)

CARANGIDÆ	<i>Caianx</i> sp	<i>Tentaculana spiracornuta</i>
SCOMBRIDÆ	<i>Cybium guttatum</i>	<i>Tentaculana macfieii</i> , <i>Tetrarhynchus pearsoni</i> , <i>Gymnorhynchus gigas</i> , <i>Otobothrium balli</i> , <i>Tetrarhynchus</i> sp. I, <i>Tetrarhynchus</i> sp. II
	<i>Thynnus</i> sp	<i>Tentaculana spiracornuta</i>
SPHYRÆNIDÆ	<i>Sphyrna commersoni</i>	<i>Tetrarhynchus</i> sp. III
LABRIDÆ	<i>Cossyphus arillaris</i>	<i>Tentaculana macfieii</i>
PLEURONECTIDÆ	<i>Psettodes erumei</i>	<i>Tentaculana macfieii</i>
SCLERODERMI	<i>Balistes stellatus</i>	<i>Tentaculana rhynchobatidis</i> , <i>T. pinnae</i> , <i>T. macfieii</i> , <i>Tetrarhynchus perideræus</i> , <i>T. balistidis</i> , <i>Otobothrium balli</i>
	<i>Balistes mitis</i>	<i>Tentaculana pinnae</i> , <i>T. macfieii</i> , <i>Tetrarhynchus balistidis</i> , <i>Otobothrium dipsacum</i> , <i>Tetrarhynchus</i> sp.
	<i>Balistes</i> sp	<i>Tetrarhynchus matheri</i> , <i>Gymnorhynchus gigas</i>
MOLLUSCA	<i>Pinna</i> sp	<i>Tentaculana pinnae</i>
	The pearl oyster (<i>Margaritifera vulgaris</i>)	<i>Tentaculana uniofactor</i> , <i>Tylocephalum dierama</i> , <i>T. minus</i>
OCELENTERATA	<i>Acromitus rabanchatu</i>	Plerocercoid larvæ

APPENDIX.

With reference to the names of the birds from which cestodes have been obtained, I have in every case accepted the name given to the host by the collector

Named birds were frequently received from the Zoological Gardens, Calcutta, in other cases the name of the host was determined by the authorities of the Indian Museum

Mr Norman B Kinnear, of the British Museum, has been good enough to provide the following remarks on these avian identifications —

Name used in this volume	Correct name
<i>Francolinus vulgaris</i>	Indian black partridge, <i>Francolinus francolinus asiæ</i> , Assam black partridge, <i>Francolinus francolinus melanonotus</i> (may be either)
<i>Pavo nigripennis</i>	A melanic aberration of <i>Pavo cristatus</i>
<i>Pterocles arenarius</i>	Black-bellied or imperial sandgrouse, <i>Pterocles orientalis</i>
<i>Crocopus phœnicopterus</i>	Bengal green pigeon, <i>Crocopus phœnicopterus phœnicopterus</i>
<i>Crocopus phayrei</i>	Ashy-headed green pigeon, <i>Dendrophassa pompadora phayrei</i>
<i>Caccabis chukar</i>	Chukar, <i>Alectoris græca chukar</i>
<i>Pica rustica</i>	Kashmir magpie, <i>Pica pica bactriana</i> , Black-rumped magpie, <i>Pica pica bottanensis</i>
<i>Corvus macrorhynchus</i>	<i>Corvus coronoides levaillanti</i> , <i>Corvus coronoides culminatus</i> (Stuart Baker, Fauna Brit India)
<i>Corvus splendens</i>	Indian jungle crow, <i>Corvus levaillanti levaillanti</i> , Common Indian house-crow, <i>Corvus splendens insolens</i>
A tragopan pheasant	<i>Tragopan</i> sp
The common caccal (<i>Centropus rufipennis</i>)	The common crow-pheasant or coucal, <i>Centropus sinensis</i>
<i>Gallus banian</i>	Indian red jungle-fowl, <i>Gallus gallus murghi</i> (Indian)
<i>Gallus ferrugineus</i>	Indian red jungle fowl, <i>Gallus gallus murghi</i> (Indian), Burmese red jungle fowl, <i>Gallus gallus robinsoni</i> (Burma)
Crow pheasant	Common crow pheasant or coucal, <i>Centropus sinensis</i>
<i>Cypselus affinis</i>	Common Indian house swift, <i>Micropus affinis affinis</i>
<i>Streptopelia cambayensis</i>	The Indian little brown dove, <i>Streptopelia senegalensis cambayensis</i>
Sonnerat's Jungle-fowl (Sonnerat's)	Grey jungle fowl, <i>Gallus sonnerati</i>

Name used in this volume	Correct name
A moonal pheasant	Impeyan pheasant or monal
<i>Lophophorus refulgens</i>	<i>Lophophorus impejanus</i>
Red turtle dove	<i>Eupopelia tranquebarica tranquebarica</i>
Ceylon hornbill	Ceylon grey hornbill
<i>Lophoceros gingalensis</i>	<i>Lophoceros griseus gingalensis</i>
<i>Larus brunnei-cephalus</i>	Indran black headed gull, <i>Larus brunnei-cephalus</i>
<i>Rostratula capensis</i>	Painted snipe, <i>Rostratula capensis</i>
<i>Upupa ceylonensis</i>	Ceylon hoopoe, <i>Upupa epops ceylonensis</i>
Whistling teal	Lesser or common whistling teal
<i>Phalacrocorax pygmaeus</i> (= <i>P. javanicus</i>)	Little cormorant, <i>Phalacrocorax niger</i>
<i>Acridotheres albobocinetus</i>	Collared myna, <i>Ethiopsar albobocinetus</i>
<i>Fuligula cristata</i>	<i>Nyroca fuligula</i>
<i>Phaenicopterus roseus</i>	Flamingo <i>Phaenicopterus ruber antiquorum</i>
<i>Tadorna cornuta</i>	Sheldrike, <i>Tadorna tadorna</i>
White checked bulbul	Indran white throated bulbul, <i>Criniger flaveolus</i> , White checked bulbul, <i>Molpastes leucogenys</i>
<i>Criniger flaveolus</i>	<i>Criniger lephrogenys flaveolus</i>
<i>Ploceus atrigula</i>	Eastern bava, <i>Ploceus passerinus passerinus</i>
<i>Brachypternus aurantius</i>	<i>Brachypternus benghalensis benghalensis</i> , <i>B. benghalensis dilutus</i> , <i>B. benghalensis puncti-collis</i>
The laughing thrush	Blanford's laughing-thrush
<i>Trochalopteron meridionale</i>	<i>Trochalopteron jerdoni meridionale</i>
<i>Limosa belgica</i>	<i>Limosa limosa</i>
Pelican	<i>Pelicanus</i> sp
Snipe	Snipe, <i>Capella</i> sp 1
Snipe (<i>Gallinago</i> sp)	Snipe <i>Capella</i> sp 2
<i>Ciconia alba</i>	<i>Ciconia ciconia</i>
Woodpecker	The large yellow naped woodpecker, <i>Chrysophlegma flavinucha</i>
<i>Urocissa occipitalis</i>	<i>Urocissa melanocephala occipitalis</i>
<i>Emberiza luteola</i>	Red headed bunting, <i>Emberiza icterica</i>
Magpie	Indian magpie, Robin
Paddy-bird (<i>Herodias garzetta</i>)	The little egret, <i>Egretta garzetta garzetta</i>
Pond heron (<i>Ardeola grayi</i>)	Indian pond heron, or paddy bird, <i>Ardeola grayi</i>
Tree pie (<i>Dendrocytta leucogaster</i>)	Southern tree pie, <i>Dendrocytta leucogaster</i>
<i>Tringus hypoleucos</i>	Common sandpiper, <i>Tringa hypoleucos</i>
<i>Cuculus vari</i>	Common hawk cuckoo (Brain fever bird), <i>Micrococcyx varius</i>
Spoon bill (<i>Platalea</i> sp)	If from India, Indian spoonbill, <i>Platalea leucorodia mayo</i>
<i>Sarcogrammus indicus</i>	Indran red wattled lapwing, <i>Lobivanellus indicus indicus</i>

The stone curlew (<i>Actinopus scolopax</i>)	The Indian stone plover, <i>Burhinus indicus</i>
? <i>Streptopelia interpres</i>	Turnstone, <i>Arenaria interpres</i>
The lesser sand plover	Small Indian pratincole or sand plover, <i>Glareola lactea</i> , or <i>Circus melanoleucos</i>
<i>Sterna bergi</i>	Large crested tern, <i>Thalasseus bergi</i>

Not Indian Birds

<i>Platycercus cumingi</i>	Rosella
<i>Cacatua moluccensis</i>	Rose crested cockatoo, <i>Kakatoe moluccensis</i>
<i>Eclectus roseatus</i>	Grand eclectus, <i>Lorius loratus</i>
<i>Lorius lory</i>	Black capped lory, <i>Doriculus lory</i>
<i>Lorius garrulus</i>	Scarlet lory, <i>Doriculus garrulus</i>
<i>Lorius pectoralis</i>	Red sided eclectus, <i>Lorius pectoralis</i>
<i>Chenopsis atrata</i>	Black swan

ADDENDA

Spiniloculus mavensis Southwell 1925 (Figs 351 & 352)

The writer in 1925 erected a new genus and species for a worm which was presented, stained and mounted, and which was obtained from a ground-shark (*Mustelus* sp) from Brisbane, Australia

It was stated in the description of this worm that each bothridium was divided into three loculi by two septa

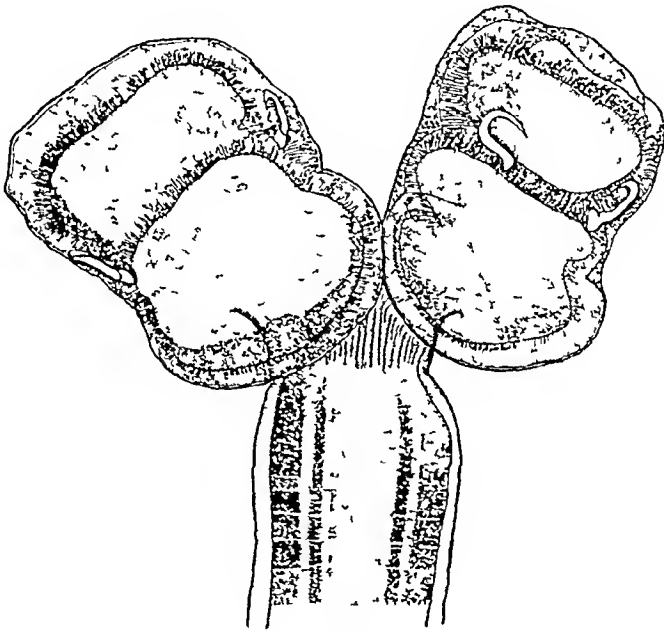


Fig 351 — *Spiniloculus mavensis* Head $\times 99$ Original

Recently five specimens of this parasite have been obtained from the spiral valve of *Chiloscyllium indicum*, Pearl Banks, Ceylon (Pearson). An examination of these worms shows conclusively that the bothridia are divided into two loculi by a single septum, and not into three loculi, as was stated in the original description. The type-species conveys the impression that there are three loculi, but it is now clear that what was thought to be a septum is, in reality, the point of attachment of the bothridium to the strobila, a fact which serves to

emphasize the necessity for examining quantities of material, both mounted and unmounted before arriving at a diagnosis.

The characters of the genus are therefore amended accordingly —

Spiniloculus Southwell, 1925. Head with four bothridia, disposed in pairs. Each bothridium is armed with a pair of simple or compound hooks, equal in size, one hook situated near each lateral margin of each septum. Genital pores marginal.

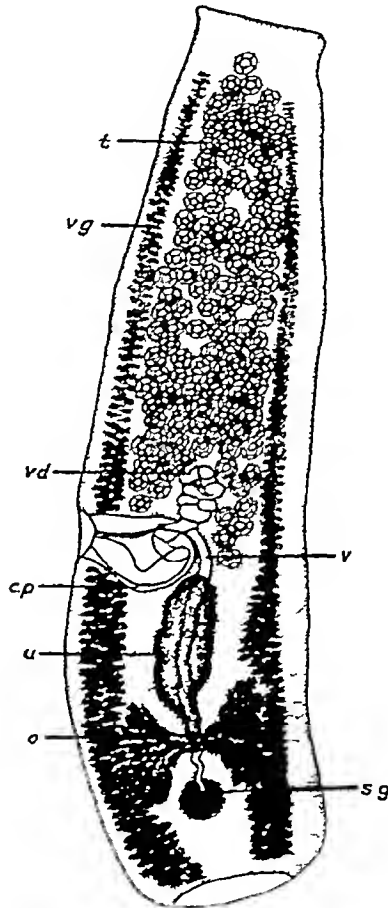


Fig. 352 — *Spiniloculus macensis*. Mature segment $\times 53$
(Original)

The genus differs from *Uncibilocularis* in the disposition of the bothridia and position of the hooks.

The worm measures about 2.5 cm. in length and has a maximum breadth of about 750μ . It is made up of about 50 segments, the posterior ones, which are not gravid, measure

3 mm in length and up to $750\ \mu$ in breadth. The genital pores are irregularly alternate and are situated a little behind the middle of the lateral margin of the segment. The head measures about $700\ \mu$ in length by $800\ \mu$ in breadth, it bears four bothridia arranged in pairs, each bothridium being divided into two loculi which are almost equal in size. At the lateral extremity of each septum there is a single undivided hook having the shape of a fish-hook with the following dimensions — Outer limb, $58\ \mu$, inner limb, $80\ \mu$, breadth of the hook, about $60\ \mu$.

Accessory suckers are absent and there is no neck.

There are about 180 testes, all of which are situated anterior to the cirrus pouch. When fully developed they are either globular, having a diameter of about $75\ \mu$, or oval, measuring about $110\ \mu$ by $70\ \mu$.

The cirrus pouch varies in shape from globular to pyriform, having a diameter of about $60\ \mu$. The cirrus is a little dilated and appears to be armed with a few small spines. A number of coils of the vas deferens lie within the pouch. Outside and anterior to the pouch a short portion of the vas deferens lies coiled in the antero-posterior axis.

The ovary is bilobed, granular, and situated posteriorly, its shape varies according to whether the segment is elongated or not.

From the pore the vagina runs parallel and anterior to the cirrus pouch, and this portion is frequently dilated. At the median extremity of the pouch it turns and runs posteriorly, often disposed in a number of coils, dilating into a small receptaculum seminis, immediately posterior to which it is surrounded by a prominent shell gland.

The vitelline gland consists of a number of acini limited to the lateral margins.

The uterus was rudimentary in all the worms examined, and consisted of a granular mass running in the antero-posterior axis and extending anteriorly as far as the cirrus pouch. Its posterior extremity is blind, the oviduct opens into it a little posterior to the level of the cirrus pouch. Eggs unknown.

Phyllobothrium gracile Wedl, 1855 (Figs 353 & 354)

Synonyms — *Anthobothrium auriculatum* Diesing, 1863

Anthocephalum gracile Linton, 1890

Anthobothrium gracile, Linton, 1890

Phyllobothrium centrale Southwell, 1925

From *Dasybatus* sp., Pearl Banks, Ceylon

The worms attain a length of about 1.5 cm and a maximum breadth of about $300\ \mu$, they are very fragile and are composed of about 60 segments, the last one having a length of 2.3 mm.

and a breadth of about $300\ \mu$. The genital pores are situated in the posterior quarter of the lateral margin of the segment, and are irregularly alternate. The head bears four funnel-shaped bothridia each borne on a stout contractile pedicel.

Linton states that each bothridium bears a single supplemental disk and also a marginal row of small loculi. Examination of a number of specimens shows that the former may be present on some bothridia in one strobila and absent on other bothridia in the same strobila. The marginal loculi do, in places, become circular, and appear as minute suckers.

The testes, which number about 60, occupy the entire field anterior to the cirrus pouch, but they do not extend



Fig 353 - *Pitylobothrium gracile* Head. Two bothridia show accessory suckers, all bothridia show crenulated margins with the formation of numerous minute marginal suckers, $\times 54$ (Original)

posterior to this organ. The cirrus pouch is very large and almost globular, extending nearly to the middle of the segment, its internal extremity turning posteriorly. It contains many coils of the vas deferens. The cirrus is armed. Internal to the pouch the vas deferens dilates into a seminal vesicle and then continues anteriorly as a much-coiled duct for a distance of about $70\ \mu$.

The ovary develops late and is situated in the posterior fifth of the segment. It appears bilobed, each half being laterally placed between the follicles of the vitelline glands, and is thus very difficult to make out. Each wing sends a process towards the middle line, from the junction of these

processes the oviduct arises and proceeds posteriorly to join the vagina

The vagina runs in front of the cirrus pouch and has a diameter of about 10μ only, including its thick wall. When it has proceeded beyond the median axis it suddenly widens in diameter and curves posteriorly, proceeding in that direction until it reaches the ovary.

The vitelline glands are arranged in two rows along each lateral margin. They increase greatly in size as they proceed

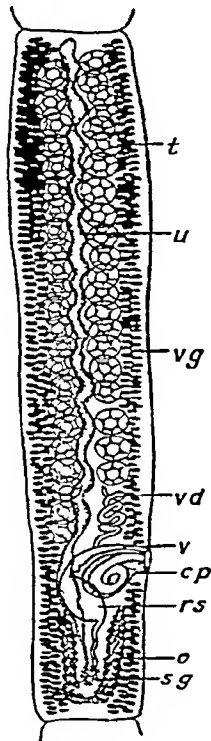


Fig. 354 — *Phyllobothrium gracile*
Mature segment, $\times 45$ (Original)

posteriorly, and attain their maximum dimensions at the level of the ovary and behind it. These posterior follicles of the vitelline glands can easily be mistaken for the ovary, which latter organ, however, develops much later. The vitelline ducts are very difficult to see in whole mounts. The shell gland (?) is situated posteriorly and is very small. The uterus begins as a coiled canal which becomes sinuous as it proceeds forwards until it reaches the anterior extremity of the segment. Eggs unknown.

Raillietina (Raillietina) maplestoni, sp. n. (Fig. 355)

From a macaw, Zoological Gardens, Calcutta. Mapleston.

The length of the worm is not known, as the material consisted of a number of fragments, some with heads. It is estimated, however, that it measures from 3 to 4 cm. and has a maximum breadth of 2 mm. All the segments are broader than long, the genital pores are unilateral and situated near the middle of the lateral margin of the segment.

The head has a maximum breadth of $350\ \mu$. The four suckers, each of which has a diameter of $90\ \mu$, are armed with several rows of minute hooks. The number of hooks on the rostellum could not be counted definitely, but it was estimated that there were from 200 to 250, they are arranged in a double row, each hook having a length of about $14\ \mu$.

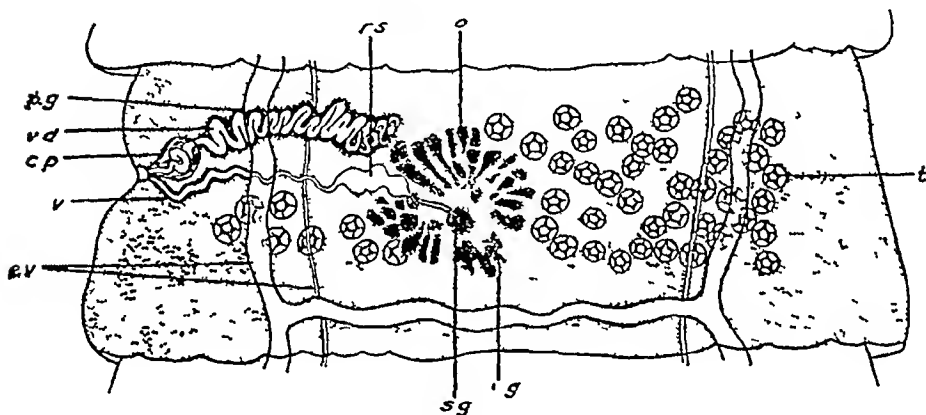


Fig. 355 — *Raillietina maplestoni*, n. sp., $\times 85$ (Original)

There is a short neck measuring about $750\ \mu$. A portion of the neck and the whole of the head are covered with extremely minute spines.

The excretory, nervous, and muscular systems were not investigated.

Male Genitalia. The male and female pores open separately at the base of a minute cup-shaped genital atrium and the vas deferens is situated in front of the vagina. The cirrus pouch is globular, very small, extending only about one-third the distance to the poral excretory vessel. The vas deferens reaches almost to the middle of the segment and is surrounded throughout its length with a conspicuous granular prostatic gland. There are in all about 48 testes, on the pore side there are about eight, all situated behind the vagina, and most of them lie lateral to the minute internal ([?]dorsal) excretory vessel. Aporally there are about 40, of which

List of Species of Raillietina (with their principal characters) which have been recorded from Psittaciformes

	<i>leptocoma</i>	<i>microscolopina</i>	<i>microscolopina</i>	<i>cacatuina</i>	<i>aruensis</i>	<i>oligorehuda</i>	<i>psittacea</i>	<i>maplestoni</i> , n. sp.
Length of worm	160 mm	60 to 80 mm	70 to 100 mm	50 mm	100 mm	*7 mm	100 mm	80 to 40 mm
Breadth of worm	2 mm	1 mm	1 mm	300 μ	2 mm	500 μ	2.3 mm	1 to 2 mm
Number of hooks	*70	*350	180	Not known	180 to 200	Not known	180	200 to 250
Size of hooks	11 to 13 μ	*20 μ	10 to 13 μ	*6 μ	18 μ	12 to 14 μ	18 to 20 μ	13 μ
Stomach	Armed	*Unarmed	Armed	Armed	*Unarmed	Armed	Armed	Armed
Spines on head	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Present
Number of testes	*50 to 60 Curves are extended to excretory vessel	About 20	19 to 24 9-10 pinal, 12-14 apical Curves are extended to excretory vessel	*4 to 5	20 14 apical, 6 pinal	*5 to 6	*20 to 25 3-6 pinal, 3-4 behind ovary, rest apical	About 48 testes Pinal—2 lateral and 4 median to the minute L.V. Apical—13 lateral and 27 median to the minute E.V.
Ovary	—	—	—	Figured symmetrically	—	Figured symmetrically	—	Markedly asymmetric
Uterus	—	—	Capsules situated between two excretory vessels	—	—	Capsules situated between excretory vessels	*Capsules situated between excretory vessels	Capsules extend lateral to excretory vessels
Host	Parakeet (<i>Psittacus erythacus</i>)	<i>Lorius (Lorius) pileatus</i>	<i>Eclectus rosalia</i> , <i>E. pectoralis aruensis</i>	<i>Cacatua galatula</i>	<i>Trichoglossus cyanocephalus nigrogularis</i>	<i>Eclectus pectoralis aruensis</i>	<i>Cacatua triton maculophia</i>	Macaw
Locality	South America	Brazil	Aru Is	Australia	Aru Is	Aru Is	Aru Is	Calcutta, (?) imported

* Species with features which differ from *R. maplestoni*

about 13 are situated immediately lateral to the minute apical (? dorsal) excretory vessel, the remainder lying median to it. No seminal vesicle was observed.

Female Genitalia The ovary is placed asymmetrically, quite markedly on the pore side, it is fan-shaped and composed of numerous cylindrical bodies. Its axis forms an angle of about 45° to the transverse axis of the segment. A conspicuous shell gland lies at the base of the ovary. Immediately behind the latter organ is a somewhat globular vitelline gland presenting a refractile granular appearance. The apical extremity of the vagina is definitely glandular. Near the ovary the vagina dilates into a receptaculum seminis.

The egg capsules extend laterally beyond the excretory vessels on both sides. Each contains from three to seven eggs.

I have been unable to determine either the species or the genus of the host from which this worm was taken. It appears, however, that macaws are limited in distribution to South America, and one must assume that the bird was imported to the Zoological Gardens in Calcutta.

The table on p. 255 gives the principal characters of species of *Raillietina* which have up to the present been recorded from Psittaciformes, and the major points in which they differ from the new species described above are indicated by an asterisk. It will be noted that the species *microcoleina* and *psittacea* are closely related to *maplestonei*, n. sp., and also that the species *aruensis* differs principally in having the suckers unaimed. It appears desirable to call attention to the fact that, as the spines on the suckers are deciduous, it is not always safe to presume their absence, especially in gravid worms, unless several heads are available for examination.

ALPHABETICAL INDEX.

[Names printed in *italics* are synonyms.]

Acanthocirrus, 170
acanthotrias (*Tænia*), 7
Acoleidæ, 2, 198
acollis (*Anomotænia*), 164
acridotherides (*Tænia*), 129
ægyptica (*Tænia*), 122
affine (*Echinobothrium*), 207
agama (*Tænia*), 76
agunæ (*Oochoristia*), 61
alba (*Moniezia*), 41
Amibolia, 194
Amabilidæ, 2, 194
americana (*Diochis*), 147
Amæbotrium, 154, 165
amphisticta, (*Oochoristia*), 64
Amphipterocotyle, 201
anatina (*Raillietina*), 103
anindalei (*Hymenolepis*), 118, 139
anindalei (*Wendlandia*), 139
Anomotænia, 155, 163
Anoplocephali, 26
Anoplocephalidæ, 2, 25
Anoplocephalinæ, 25
Aphanobothrium, 194
Aporina, 26, 45
arctus (*Pentorelis*), 171
arctos (*Pentorelis*), 171
armata (*Tænia*), 7
armata humana (*Tænia*), 7
articum (*Notobothrium*), 151
arvensis (*Davainea*), 78
aruensis (*Raillietina* [E]), 78

? *asymmetrica* (*Hymenolepis*), 147
asymmetrum (*Diagonobothrium*), 214, 215
auriculatum (*Anthobothrium*), 251
avicola (*Cittotænia*), 43, 110
Avitellina, 49, 53

barbara (*Oinomotænia*), 159, 161
benedeni (*Moniezia*), 37, 39, 40
benedeni (*Tænia*), 40
Bertielli, 26, 43
bisfura (*Cotugma*?), 107
bummuni (*Raillietina* [F]), 100, 191
bovi (*Echinobothrium*), 204, 206
Bothridiotænia, 201
Bothriotænia, 74
botrioplites (*Tænia*), 74, 100
Brochocephalus, 199
biotogeys (*Cotugma*), 107, 109
bursaria (*Cittotænia*), 42

calva (*Davainea*), 91
calva (*Tænia*), 91
campylancistota (*Hymenolepis*), 155
campylancistota (*Tænia*), 155
caninum (*Dipylidium*), 175, 176
canis (*Cysticercus*), 7
canis lagopodis (*Tænia*), 190

capillaroides (*Hymenolepis*), 147
capillaroides [*Wardium*], 147
caroli (*Hymenolepis*), 132
caroli (*Tænia*), 132
carrineri (*Paionia*), 47
catenata (*Amibolia*), 194
catenatum (*Aphanobothrium*), 194
celebensis (*Davainea*), 77
celebensis (*Raillietina* [R]), 77
celebensis vari capsulata (*Raillietina* [R]), 90
cellulosa (*Cysticercus*), 21
centripunctata (*Avitellina*), 53
centripunctata (*Avitellina*), 57
centripunctata (*Stilesia*), 57
centropi (*Raillietina* [S]), 97, 98
centurum (*Phyllobothrium*), 251
cercopitheci (*Bertielli*), 44
cerebralis (*Caninus*), 16
cerebralis (*Hydatigena*), 16
cerebralis (*Tænia*), 16
cesticillus (*Raillietina* [S]), 97
ceylonica (*Raillietina* [P]), 94
chandleri (*Monopylidium*), 179
Choriotænia, 154, 159, 181

- Ottotænia*, 26, 41
clausa (Hymenolepis), 118, 126
clerci (Hymenolepis), 119, 144
clerci (*Wardum*) 144
cæmurus (*Polycephalus*), 16
cæmurus (*Tænia*), 16
cohi (*Davainea*), 78
cohi (*Railletina* [R]), 78
? collaris (Hymenolepis), 146
collo bivittato (*Tænia*), 18
columbæ (Hymenolepis), 131
columbæ (*Moniezia*), 47
columbæ (*Paionia*), 47
conferta (*Bertiella*), 44
conferta (*Tænia* [Berti]), 44
conjugens (*Moniezia*), 40
? constricta (*Anomotænia*), 165
contorta (*Railletina* [P]), 97
cordata (*Hydatigena*), 14
coronula (*Dicranotænia*), 132
caronula (Hymenolepis), 119, 122
coronula (*Tænia*) 132
coronula (*Weinlandia*), 132
corvina (*Railletina* [P]), 93
Cotugnia, 70, 107
crassa (Hymenolepis) 119
crassiceps (*Oochoristica*), 62
crassicollis (*Moniezia*) 40
crassicollis (*Tænia*) 18
crassicollis var *nova* (*Moniezia*), 40
crucata (*Railletina* [P]), 93
cryptobothria (*Oochoristica*), 60
Cryptocystis 175
cucurbitina (*Tænia*), 7, 9
ci neata (*Amæbotænia*), 165
cuneata (*Dicranotænia*), 165
cuneata (*Tænia*), 159, 165
cuneata var *nervosa* (*Cotugnia*), 107, 113
cuneata var *tenuis* (*Cotugnia*), 107, 112
cuneuli (*Cæmurus*), 20
Cyclophyllidea, 1
Cycloclinda, 155, 173
dahurica (Hymenolepis), 129
Davainea, 70, 72
davainea - tetragona (*Monocercus*), 74
Davaineidæ, 2, 69
Davaineia, 69
decacantha (*Chonnotænia*), 159, 160
delafondi (*Aporina*), 45
delafondi (*Berti*), 45
delafondi (*Bertiella*) 45
delafondi (*Tænia*), 45
Deltoceras, 155, 172
Deltoleras, 154
dendrocitta (*Rhabdometra*), 186, 188
dentata (*Tænia*), 7
Digonobothrium, 214
Dicranotænia, 118
digonophora (*Cotugnia*), 107
digonophora (*Tænia*), 107
Diplophidæ, 2, 153
Diplophidæ, 153
Dilepis, 154
Dilepis, 155
diminuta (Hymenolepis), 118, 119
diminuta (*Tænia*), 119
diminutoides (Hymenolepis), 119
Diæcolestidæ, 1, 202
Diæcolestus, 202
Diploanthus, 118
Diplochetos, 163
Diploposthe, 197
Diploposthidae, 2, 197
Dipylidium, 154, 175
Dipylidium, 175
Discocephalum, 212
dispar (? *Nematotænia*), 194
dispar (*Tænia*), 194
Drepanidotænia, 118
Echinobothrium, 203
echinococca (*Tænia*), 12
echinococcus (*Echinococcifer*), 12
echinococcus (*Tænia*), 12
echinococcus (*Tænia* (*Archynchotænia*)), 12
echinococcus (*Tænia* (*Echinococcifer*)), 12
echinococcus (*Tænia* (*Echinococcus*)), 12
Echinocotyle, 149
equi (*Tænia*), 30
equina (*Tænia*), 27, 30
eostoma (*Prostheccotyle*), 201
erostris (*Rhynchotænia*), 201
erosus (*Tænia*), 201
erosus (*Leitabothrium*), 201
Edictrabothrium, 201
expansa (*Moniezia*) 37, 39
expansa (*Tænia*), 39
facilis (*Railletina* [P]), 96
fumosa (*Railletina* [R]), 88
fascicularis (*Diploanthus*), 129
fascicularis (Hymenolepis), 129
fascicularis (*Tænia*), 129
fasciminosa (Hymenolepis), 119, 129
fasciminosa (*Tænia*), 129
fasciminosa (*Weinlandia*), 129
fasciata (Hymenolepis), 146
fasciolaris (*Cysticercus*), 18
fasciolaris (*Fimbriaria*) 151
fastigata (*Cotugnia*), 107, 111
fatalis (*Railletina*), 104
fibrata (*Oochoristica*), 67
ficticia (Hymenolepis) 118, 141
ficticia (*Weinlandia*), 141
figuata (*Oochoristica*), 66
Fimbriaria, 118, 151

- flabralis* (Railletina [R]), 89
flacida (Railletina [R]), 88
flavomaculata (Tænia), 119
flavopunctata (Hymenolepis), 119
flavopunctata (Lepidotrias), 119
flavopunctata (Tænia), 119
flava (Railletina), 105
friedbergii (Railletina [R]), 76
friedbergii (Tænia), 76
Fuhrmannetta (= Johnstonia), 74, 99
fuhrmanni (Cotugma), 107, 108
fuhrmanni (Davamea), 81
fuhrmanni (Railletina [R]), 81
funbris (Railletina), 105
furcata (Hymenolepis), 119, 134
furcata (Lepidotrias), 134
furcata (Tænia), 134
furcata (Weinlandia), 134
fusca (Hymenolepis), 119, 124
fusca (Tænia), 124

gugerii (Multiceps), 22
gugerii (Tænia), 22
galbulæ (? Choanotænia), 162
galbulæ (Tænia), 159, 162
gallinarum (Monopygidium), 180
gallinarum (Southwellia), 180
gervaisi (Dipylidium), 175, 177
gigantea (Anoplocephala), 27, 32
gigantea (Plagiotænia), 32
gigantea (Schizotænia), 32
gigantea (Tænia), 32
globiceps (Anoplocephala), 30
globiceps (Tænia), 30
globipunctata (Stilesia), 50
globipunctata (Tænia), 50

goughi (Avitellina), 53, 57
gracile (Anthobothrium), 251
gracile (Anthorephalum), 211
gracile (Phyllobothrium), 251
gracilis (Drepanidotænia), 130
gracilis (Hymenolepis), 118, 130
gracilis (Tænia), 130
gracilis (Weinlandia), 130
granulosus (Echinococcus), 12
Gryposhynchus, 155, 170
Gyrocecia, 199

humana aemata (Tænia), 7
hydatigena (Tænia), 11
hydatigena (Tænia), 18
hydatula (Hydria), 11
hydropicus (Lumbricus), 11
Hymenolepidida, 2, 116
Hymenolepis, 118
hymenolepis - diminuta, (Cysticercus), 119

Ictrotænia, 159
incognita (Flussmollia), 68
indica (Railletina), 105
inermis (Tænia), 9
inexpectata (Hymenolepis), 122
infundibuliformis (Choanotænia), 159
infundibuliformis (Drepanidotænia), 159
infundibuliformis (Monopygidium), 159
infundibuliformis (Lænia), 159
infundibuliformis (Phasianorum) (Tænia), 77
infundibulum (Choanotænia), 159
innominata (Choanotænia), 161
interrupta (Hymenolepis), 144
interruptus (Hymenolepis), 144

Johnstonia (= Fuhrmannetta), 99

kempii (Dilepis), 127
kempii (Hymenolepis), 118, 127
koikeri (Railletina [F]), 100, 102

levis (Diplopisthe), 198
levis (Tænia), 198
lihorer (Avitellina), 53

lamelligera (Amabilia), 132
lamelligera (Amabilia), 194
lamelligera (Tænia), 194
lanceolata (Drepanidotænia), 121
lanceolata (Hymenolepis), 118, 121
lanceolata (Tænia), 121
lata (Tænia), 9
Lateporus, 154, 157
latifrons (Moniezia), 40
latissima (Anoplocephala), 32
latissima (Plagiotænia), 32
latissima (Schizotænia), 32
Lepidotrias, 118
leporina (Tænia), 42
leptocephala (Tænia), 119
leptosoma (Railletina [R]), 75
leptosoma (Tænia), 75
lignoides (Drepanidotænia), 132
liguloides (Halysis), 132
liguloides (Hymenolepis), 118, 132
liguloides (Tænia), 132
liguloides (Weinlandia), 132
lineata (Halysis), 190
lineata (Ptychophysa), 190
lineata (Tænia), 190
lineatus (Mesocetoides), 190
Linstownia, 79
Linstownia, 25, 58
litteratus (? Mesocetoides), 190
longa (Plagiotænia), 32

- phalacrocorax* (*Wenlandia*), 143
plicatum (*Dicocephalum*), 212
Ptilonia, 211
pisiformis (*Cysticercus*), 14
pisiformis (*Hydatigena*), 14
pisiformis (*Tænia*), 11
pisiformis (*Vesicaria*), 14
pluma (*Timbimania*), 151
planissima (*Momezia*), 40
planissima var *lobata* (*Momezia*), 40
plicata (*Tænia*), 30
plicata var *pediculata* (*Anoplocephala*), 30,
plicata var *rusticata* (*Anoplocephala*), 30
plicata var *severi* (*Anoplocephala*), 30
plicata var *triangulata* (*Anoplocephala*), 30
polycalcaria (*Davamea*), 43
polycalcaria (*Tænia*), 3
polychalis (*Davamea*), 80
polychalis (*Railletina* [R]), 80
polymorphus (*Echinococcus*), 12
polyorchis (*Bertia*), 44
Pocho motrema, 175, 118
proglottina (*Davamea*), 72
proglottini var *dublanensis* (*Davamea*), 72
Prosthecocotyle, 201
pseudo-cucumerina (*Tænia*), 190
pseudoechinobothrid (*Railletini* [F]), 101
pseudocryptica (*Tænia*), 190
Ptychophysa, 189
pustillus (*Gypporhynchus*), 170
pyriformis (*Cysticercus*), 7

quadriata (*Cittotæmia*), 42
quadrilobata (*Tænia*), 27
quadrilateralis (*Railletini* [R]), 87

Railletina, 70, 74
Railletina (subgen.), 74
Ransomia, 74

relicta (*Hymenolepis*), 119
relicta (*Tænia*), 119
relicta (*Anoplocephala*), 30
retracti (*Tænia*), 22
roynoldsi (*Railletina*), 103
Rhabdometra, 184, 186
rhinoptera (*Echinobothrium*), 208
rosseteri (*Echinocotyle*), 149
rugosa (*Hymenolepis*), 126
rustica (*Hymenolepis*), 118, 141
rustica (*Wenlandia*), 141

signata (*Tænia*), 9
satyri (*Bertia*), 41
satyri (*Bertiella*), 44
scini (*Cotugma*), 107, 113
septaria (*Hymenolepis*), 119, 123
serialis (*Caninus*), 20
serialis (*Caninus*), 22
serialis (*Multiplex*), 20
serialis (*Tænia*), 20
serpentiniformis (*Tænia*), 162
serrata (*Tænia*), 11, 18
serrata canis domesticæ and *vulpis* (*Tænia*), 14
sacronatum (*Dipylidium*), 175, 178
sigmoidea (*Oochonistica*), 65
simplex (*Hymenolepis*), 119, 137
simplex (*Wenlandia*), 137
Skrjabinia, 74, 97
socialis (*Vesicaria*), 16
solitaria (*Hymenolepis*), 119, 142
solitaria (*Wenlandia*), 142
solum (*Halysis*), 7
solum (*Tænia*), 7
solum (*Tænia*), 9
solum (*Tænia* (*Cystotænia*)), 7
Southwelli, 175, 180
Species (*Anoplocephala*), 36
Species (*Cestoda*), 215
Species (*Chorotænia*), 163

Species (*Dilepis*), 157
Species (*Dipylidium*), 178
Species (*Dithyridium*), 193
Species (*Hymenolepis*), 119, 147, 148
Species (*Linstownia*), 59
Species (*Railletina*), 105, 106
Species (*Tænia*), 16, 18, 24
sphenocephala (*Hymenolepis*), 118, 131
sphenocephala (*Tænia*), 45
sphenocephala (*Wenlandia*), 131
sphenoides (*Amæboctoma*), 165
sphenoides (*Dicranotænia*), 165
sphenoides (*Tænia*), 165
spinosa (*Hymenolepis*), 119, 124
spinosus (*Lateiporus*), 157
spiralis (*Railletina* [R]), 79
stilesii, 49, 30
studenii (*Bertia*), 44
studenii (*Bertiella*), 44
stylous (*Hymenolepis*), 137
suis (*Cysticercus*), 7

Tænia, 7
tænia-diminuta (*Cysticercus*), 119
tæniiformis (*Hydatigena*), 18
tæniiformis (*Tænia*), 18
Tænioides, 1, 2
Tænioides, 1
Tænfia, 167
tenuicollis (*Cysticercus*), 11, 21
Tetrabothridæ, 1, 201
Tetrabothrius, 201
tetragona (*Davamea*), 74
tetragoni (*Railletini* [R]), 74
tetragona (*Tænia*), 74
Thysanosoma, 49, 50
Thysanosomæ, 25, 49
Thysanotænia, 59, 66
tomica (*Rhabdometra*), 186, 187

- torquata* (*Houttuynia*),
84
torquata (*Railletina*
[R]), 84
triagonum (*Railletina*
[P]), 95
translucida (*Momezia*), 40
triangularis (*Momezia*),
40
trigonophora (*Momezia*),
39
Triorchus, 118
tiopicus (*Bothriocephalus*), 9
typus (*Echinobothrium*),
204

urilensis (*Echinocotyle*),
149, 150
urogalli (*Railletina*
[P]), 91
urogalli (*Tænia*), 91
utricularis (*Hydatigena*),
14
utriculenta (*Hydatigena*),
14

varecina (*Tænia*), 119
variabilis (*Cittotænia*),
42
variabilis (*Cicnotænia*),
42
variabilis angusta (*Cittotænia*), 42
variabilis umbicata (*Cittotænia*), 42
varians (*Davamea*),
72
vesicularis cecibina
(*Tænia*), 16
vesicularis eremita (*Vermis*), 11
vesicularis muris (*Vermis*), 18
vesicularis pisiformis
(*Vermis*), 14
vesicularis socialis (*Vermis*), 16
vesicularis tenuiformis
(*Vermis*), 18
veterinorum (*Echinococcus*), 12
vittata (*Stilesia*), 50, 51

volvulus (*Anomotænia*),
163
volvulus (*Diplochetos*),
163
vulgaris (*Anoplocephala*),
32
vulgaris (*Plagiotænia*),
32
vulgaris (*Tænia*), 7

walleri (*Dipylidium*),
176
Waidum, 118
Weinlandia, 118

zebræ (*Anoplocephala*),
30
zebræ (*Tænia*), 30
zeylanica (*Ophryocotyle*),
114
zosteropsis (*Hymenolepis*)
118, 137
zosteropsis (*Weinlandia*)
137

